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LATE RESULTS IN TREATMENT OF PANCREATIC CYSTS BY INTERNAL DRAINAGE

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PANCREATIC cysts are encountered so infrequently in the clinical experience of any one surgeon that the question of treatment of such a lesion when it presents may pose a problem of difficult decision. The diverse etiology, association with acute and chronic pancreatitis and biliary pathology, and the tendency to drain for long periods and to recur, all serve to complicate any outline of treatment. The purpose of this paper is to consider briefly the classification, etiology, diagnosis, and treatment of cysts of the pancreas, and to report 3 cases, 2 of which have been observed for a period of 7 to 8 years, following internal drainage.

CLASSIFICATION

In the literature one may find many classifications of pancreatic cysts (11, 20, 21). The classification used by Mahorner and Mattson (15, 12) is one of the best:

1. Cysts due to defective development
   a. In infants
   b. Associated with polycystic disease of kidneys
   c. Dermoid cysts
   d. Inclusion
2. Cysts due to trauma
3. Retention cysts
4. Neoplastic cysts
   a. Cystadenoma
   b. Cystadenocarcinoma
   c. Teratoma
5. Cysts due to parasites

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Cysts are spoken of as true cysts and pseudocysts. The former term implies those with a lining completely formed by epithelium or by pancreatic tissue. The pseudocysts, which are predominately formed by trauma, vascular or degenerative changes, frequently do not lie entirely within the pancreas, but are located within the lesser peritoneal sac, between the stomach and liver or between the leaves of the mesocolon. Practically speaking, it is frequently impossible to distinguish at operation between true and pseudocysts, as the former may lose their epithelial lining after some time, and present the appearance of a pseudocyst.

Pancreatic abscesses or collections, as Pinkham prefers to call them, may also present a differential diagnostic problem, as these may result from the same factor as pseudocysts. Here the rapidity of appearance, plus signs of infection, helps to distinguish them. This group of pancreatic collections might well form a sixth group in the classification scheme presented, as being due to acute and chronic pancreatitis, pancreatolithiasis with infection, and concurrent biliary disease.

ETIOLOGY

In their article in 1931, Mahorner and Mattson considered in some detail the etiology and pathology of pancreatic cysts (15, 12). In general, their discussion follows closely the classification given by them.

Probably the most common cyst is the simple retention type, which is frequently an incidental finding at necropsy (16). These are small, may be multiple and result from the occlusion of a duct or several acinar openings, by fibrosis, inflammation, or neoplastic changes (4). Occasionally, pancreatic calculi are found in association with these (17).

Cysts which result from defective development are rare, and may be seen in children and infants with other congenital anomalies, such as polycystic kidneys and congenital heart disease. Dermoid and inclusion cysts may be included in this category.

Neoplastic change in the pancreas can produce cystic degeneration by occlusion of main ducts or smaller branches. In cystadenocarcinoma, new cysts may be formed by acinar proliferation and secretion. This is rather unusual, however, since most pancreatic tumors present as solid growths.

The production of cysts of the pancreas by parasites is rare, and is due to encystment of the organisms or blockage of the duct system.

A history of trauma is elicited in a significant number of pancreatic cysts (2, 12, 15, 21, 22). This need not be severe, or recent, and may follow minor blows and inconsequential abdominal injury. The pancreas, a relatively immobile abdominal organ, is caught between the force applied to the abdomen anteriorly and the spine posteriorly, with resulting laceration, contusion, or hemorrhage. Almost all cysts resulting from trauma are pseudocysts, with a portion of their wall being formed by the lesser peritoneal sac or mesocolon.

A mass may present early or late trauma. The insignificant amount of trauma required may be forgotten by the patient and the appearance of the cyst be considered as without due cause. The pathologic changes which occur may be hemorrhage with later degeneration, autolysis by pancreatic ferments, or a combination of the two.

Recently, the role of acute and chronic pancreatitis in the pathogenesis of pancreatic cysts has been emphasized (19, 26). These processes probably account for a greater proportion of cysts than has formerly been recognized. Pinkham points out that both true and pseudocysts may be formed. The part played by degeneration, obstruction, and concurrent biliary disease are all to be considered. Each case must be individualized and the final summation of opinion may not be possible even at laparotomy.

DIAGNOSIS

The most frequent symptom of pancreatic cyst is abdominal discomfort or pain (1, 2, 5). This is experienced in the hypochondrium, epigastrium, or back, is constant in nature and of dull aching nature. The presence of pancreatitis concurrently or previously will modify to some extent the degree of pain (19).

Symptoms from pressure of the cyst on the stomach, duodenum, or colon may be noted. These take the pattern of anorexia, nausea, vague indigestion, eructations, and even vomiting. In the presence of chronic pancreatitis or biliary pathology, there may also be fatty-food intolerance and signs of pancreatic or biliary insufficiency (20).

A palpable mass may be found on physical examination, is the most reliable single finding, and is almost essential for diagnosis. The mass may occupy almost any position in the upper abdomen, but is characteristically high, relatively immobile, and somewhat tense.

Roentgenologic examination (8) may demonstrate a slight opacity in the area and displacement of gas-filled organs such as the stomach, duodenum, or colon. Gastric pneumograms are especially helpful (19). Pyelography and barium enema may reveal further displacement of surrounding organs. More contributory evidence may be gained from cholecystograms revealing biliary dysfunction.

Determination of serum amylase levels may be of value in dealing with trauma, acute pancreatic degeneration, or pancreatitis. Laboratory studies may reveal mild diabetes mellitus (with abnormal glucose and insulin tolerance curves), free stool fat, and a paucity of pancreatic ferments in duodenal drainage specimens.

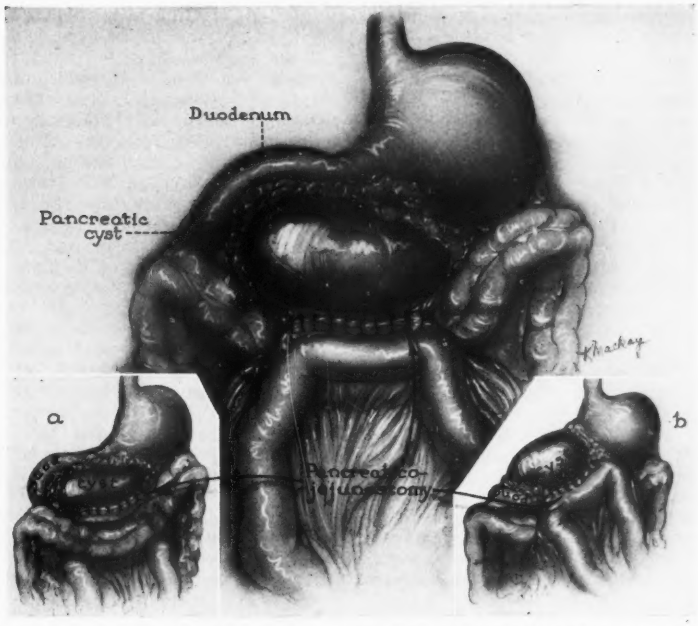

Fig. 1. Anastomosis of pancreatic cyst to jejunum. Insert (a) depicts retrocolic anastomosis through mesocolon for cases in which stomach is displaced upward. Insert (b) shows antecolic anastomosis used when the cyst presents superiorly. In each instance, the width of the stoma is not less than 4 centimeters.

SURGICAL TREATMENT

Surgical intervention is indicated in every case of suspected or proved pancreatic cyst. Conservative management makes the patient vulnerable to possible rupture (13) into the peritoneal cavity with resultant hemorrhage, shock, or peritonitis, or internally into some portion of the gastrointestinal tract.

Three methods of surgical treatment may be employed in management (3, 5, 6): total excision which is admittedly the ideal; simple drainage by catheter or marsupialization; and internal drainage by anastomosis of the cyst to the stomach, duodenum, or jejunum.

Total excision may be possible in the case of small cysts, particularly those located in the tail of the pancreas. Excision is to be performed whenever possible because of small size or freedom from intimate involvement of surrounding structures.

Simple drainage (3, 18, 23, 24) by means of a large rubber catheter, a cigarette drain, or marsupialization of the cyst may be employed in those cases unsuitable for excision. The specific method of drainage to be used is indicated in part by the position of the cyst and its relations to adjacent structures. Disadvantages of simple drainage are the persistence of draining fistulas, excoriation of the skin, and tendency to recur.

Internal drainage (1, 10, 14, 25) by anastomosis of the cyst wall to the stomach or small intestine will obviate the disagreeable features of external drainage and will insure adequate drainage. Although the site of anastomosis depends somewhat on the location of the cyst, the usual procedure is a cystojejunostomy with the use of two layers of sutures.

CASE REPORTS

CASE 1. P.P., aged 49 years, white male, was admitted to the Piedmont Hospital on August 5, 1946 with the chief complaint of severe epigastric pain of 30 hours' duration. The pain had begun suddenly, remained constant, and was accompanied by per-

sistent nausea and vomiting. Physical examination revealed a robust man of middle age, in acute distress. Temperature was 101 degrees F., pulse 120, blood pressure 90/60. The abdomen was slightly distended with moderate rigidity and hypoactive peristalsis. Roentgenologic examination revealed no free air in the peritoneal cavity. Diagnosis of acute pancreatitis was made, and conservative therapy instituted. After 24 hours, the abdomen became progressively more distended, pain was still present, and there was muscle spasm. Exploratory laparotomy was performed. A marked hemorrhagic necrosis of the pancreas was found, drains were placed down to the area, and the abdomen closed. Following operation, convalescence was uneventful except for transient jaundice and glycosuria. The operative wound healed by primary intention and drainage stopped on the seventeenth hospital day. He was discharged home on the twenty-first hospital day, free of symptoms.

Approximately 2 months later, on October 11, 1946, the patient was readmitted because of the appearance of an upper abdominal mass associated with nausea and vomiting. Physical examination revealed a palpable mass in the epigastrium. Pancreatic cyst was suspected, and abdominal exploration performed. Upon opening the peritoneal cavity, the pancreas presented a large cystic mass posterior to the mesocolon and below the stomach. The cyst was opened and a large amount of serosanguineous fluid and blood clots removed. The biliary tree was distended and of a deep greenish-brown color. Cholecystostomy was performed and the pancreatic cyst marsupialized. The postoperative course was uneventful and the patient was discharged home on the twentieth hospital day with drainage present from both openings.

During the ensuing 10 months he was under close observation as an outpatient. Drainage continued from both the cholecystostomy and pancreatic fistula with minimum skin irritation. Blood clots were passed intermittently; however there was no pain or gastrointestinal symptoms to indicate biliary or pancreatic dysfunction. His appetite remained good and he gained weight. An incisional hernia, noted 2 months after operation, gradually increased in size.

Eleven months after operation, drainage ceased and the fistulous tract closed. During the following year the patient remained asymptomatic, returned to work, and continued to gain weight. All laboratory studies subsequent to hospital discharge were within normal limits.

The patient was admitted to the hospital in May 1948 for further study and repair of the incisional hernia. Laboratory studies revealed a normal glucose tolerance curve. Stool examinations were negative for occult blood and free stool fat; urinalyses were negative. Oral cholecystogram revealed normal filling of the gall bladder with no evidence of stones. Ventral herniorrhaphy was performed, the wound healed well, and patient was discharged home on the fourteenth hospital day with a well healed wound. At the time of this report he is in excellent health and asymptomatic (3 years).

CASE 2. (Patient of Dr. W. A. Selman.) G. J., aged 46 years, colored female, was admitted to the Grady Memorial Hospital May 4, 1939, complaining of an upper abdominal mass of insidious onset and without previous pain or gastrointestinal upset. There was no history of abdominal disease or trauma. Physical examination revealed an obese female with no discomfort. Temperature, pulse, and respiration were normal. Blood pressure was 130/70. The abdomen was moderately obese, and there was palpable in the epigastrium a large, smooth, tense, nontender mass which appeared to be fixed posteriorly and did not move with respiration. Roentgenologic study revealed a retroperitoneal mass displacing the stomach anteriorly. A provisional diagnosis of pancreatic cyst was made and exploratory laparotomy performed. A large pancreatic cyst posterior to the stomach was marsupialized. Postoperative course was uneventful; the cyst drained well, and the patient was discharged home on the fourteenth postoperative day with a draining fistula, to be followed in the outpatient department. After draining for 3 weeks, the cyst opening closed, and no further drainage occurred. The patient remained asymptomatic until approximately 2 years later, when in August 1941, she was seen in the outpatient department, complaining of recurrence of the mass in the same location. There was a sensation of epigastric fullness, eructation, and occasional vomiting without pain. A diagnosis of recurrent pancreatic cyst was made, and re-exploration performed. The cyst was found to have reformed, and was considerably larger than on the previous operation. Because of recurrence following simple drainage, it was thought that internal drainage was indicated. Cystogastrostomy was done, in which the cyst wall was anastomosed to the posterior wall of the stomach. Postoperatively the patient's progress was good, and the cyst decreased in size. Dehiscence of the operative wound down to peritoneum occurred on the fifth postoperative day. Secondary suture was performed, and the wound healed well. The patient was discharged home on the twenty-eighth postoperative day. At this time and on follow-up a month later, she was free of gastrointestinal symptoms, was eating a regular diet, and there was no palpable abdominal mass. A small incisional hernia was present; however, at that time it was not deemed advisable to repair it.

From 1941 until November 1947, the patient was seen at irregular intervals in the surgical outpatient clinic. Repair of the incisional hernia was advised upon several occasions, but refused by the patient. There were occasional bouts of nausea and vomiting, diarrhea, and an intolerance to fatty foods. In November 1947, she was seen in the emergency clinic with nausea, vomiting, and mild abdominal pain. Examination revealed a large incisional hernia with no evidence of intestinal obstruction. She was admitted to the surgical service for study and possi-

ble repair of the wound defect. Temperature, pulse, respiration, and blood pressure were normal. The patient had gained considerable weight since the last hospital admission, and the abdomen was markedly obese. A large upper abdominal incisional hernia was present, and through the defect palpation of the upper abdominal viscera was possible. No masses were felt and there was no tenderness.

Roentgenologic study of the gastrointestinal tract was entirely normal, and revealed no defect in the outline of the stomach, and no filling of the cyst through the previous cystogastrostomy. The gall bladder was not visualized by an oral cholecystogram. Laboratory studies, including glucose and insulin tolerance tests, revealed no diabetic trends. Blood studies and urinalyses were normal. Free fat was demonstrable in the stools. The serum amylase level was within normal limits. A diagnosis of chronic pancreatitis was made, and therapeutic dosage of pancreatin was given with considerable relief of symptoms. Fatty food intolerance disappeared, there was a diminution in the number of daily stools, and free stool fat was no longer demonstrable.

Herniorrhaphy was again refused and the patient was discharged home on a high protein, low fat diet, with therapeutic doses of pancreatin. During subsequent outpatient visits, and at the time of this report, she is asymptomatic.

CASE 3. C.L.C., aged 17 years, white male, was admitted to Grady Memorial Hospital on February 17, 1940, complaining of severe upper abdominal pain. Forty-eight hours before admission he had fallen across a large stone, receiving a sharp blow to his epigastrium. Nausea without vomiting developed, and there was pain on deep respiration. The patient was reported to have voided urine which was grossly bloody.

Physical examination revealed a young man in acute distress, with shallow respiration and complaining of severe abdominal pain. Temperature was 101 degrees F., pulse 90, blood pressure 140/90. The abdomen was rigid, exquisitely tender, with hypoactive peristalsis. No masses were palpable. There was tenderness in the left costovertebral angle.

Laboratory studies revealed a white cell count of 24,000 with a neutrophilic response. Urinalysis was negative except for an occasional red blood cell.

Roentgenograms of the upright abdomen revealed no free air under the diaphragms and an increased density in the epigastrium. Retrograde pyelograms were normal in appearance.

Surgical intervention was deferred and conservative therapy instituted. The patient improved steadily and was discharged on the eleventh hospital day, asymptomatic except for residual tenderness in the epigastrium. He continued to improve until March 31, 1940 when, shortly after an airplane trip, he became nauseated and vomited. Thereafter he vomited from one to three times daily without nausea. On April 3, 1940, he was readmitted for study.

At this time his temperature, pulse, and respiration were normal. Blood pressure was 164/80. He appeared acutely ill and a large cystic mass filled the epigastrium. Exploratory laparotomy was performed on April 5, 1940, and the lesser peritoneal sac was found to be distended with approximately 1500 cubic centimeters of serosanguineous fluid. A pancreatic pseudocyst was drained with two soft rubber drains. Examination of the fluid revealed the presence of pancreatic ferments.

Drainage was profuse and continued for 25 days, when it ceased abruptly. The mass began to re-form and 6 days later operation was performed to re-establish drainage. This persisted for 2 months and caused considerable excoriation of the surrounding skin.

On July 12, 1940, a second laparotomy revealed a rent 3 centimeters in length in the anterior surface of the pancreas. This was closed with interrupted chromic catgut sutures and drains placed down to this area. Postoperatively, the volume of drainage steadily decreased, and on August 2, 1940, patient was discharged to be followed in the outpatient clinic. Six weeks after discharge the fistula closed, and the epigastric mass reappeared. The patient was readmitted and given conservative management. The mass disappeared in 10 days. The patient was discharged, and throughout the next 12 months was seen at frequent intervals in the outpatient department. The cyst recurred and was evacuated on 10 occasions by aspiration, yielding amounts varying from 750 to 1800 cubic centimeters. During this period, he occasionally exhibited evidence of hypoglycemia. He was admitted for study, and though the fasting blood sugar levels were at the lower limits of normal, the glucose tolerance curves were normal and his symptoms could not be reproduced by starvation.

The mass was still present 14 months after the last operation in July 1940. The patient was readmitted and on September 24, 1941, through a high left rectus incision, an antecolic cystojejunostomy was performed, two layers of interrupted silk sutures being used. Postoperative course was uneventful, and he was discharged from the hospital on October 12, 1941.

One year later, he was readmitted for study. The opening into the cyst could not be demonstrated on fluoroscopic examination of the barium-filled intestine. Glucose tolerance tests were normal.

Nothing further was heard from the patient until April 1, 1946, when he was transferred to a nearby army camp. He had entered the service early in 1943 and later was taken prisoner. He had been well throughout this period and had suffered no symptoms of hypoglycemia even while on a very low caloric diet during a 9 month period of incarceration in an enemy prison camp. At the time of examination, he appeared to be well nourished and in excellent health. No abdominal mass or tenderness could be detected. All laboratory studies, including glucose tolerance tests, were within normal limits.

DISCUSSION

The etiology and classification of pancreatic cysts are matters largely of academic interest, since treatment is in nearly all cases identical. Exploration is strongly indicated in every instance of a palpable upper abdominal mass for several reasons. An operable malignant lesion may be present in association with the cystic mass. Temporization in the case of a true or pseudocyst may allow spontaneous or traumatic rupture to occur. In a series of 6 cases of rupture reported by Koucky, there were 4 deaths (60 per cent mortality). Moreover, chances of spontaneous internal drainage or regression are rare.

Of the three methods available for treatment, internal drainage is the treatment of choice. Total excision is an ideal seldom attainable. External drainage or marsupialization offers the advantages of ease of performance and low mortality, but entails prolonged drainage, varying degrees of skin excoriation, and the possibility of cyst recurrence.

Properly performed internal drainage, while presenting a more difficult technical problem, secures adequate drainage without external irritation or need for prolonged dressings. The loss of fluid, enzymes, or electrolytes is obviated by their passage into the alimentary tract for utilization or absorption. The experience of other authors, together with the 2 cases reported, does not substantiate the tentative objection that internal drainage allows ingress of gastrointestinal juices to keep active inflammation in the cyst wall, and thus to encourage persistence of the cyst cavity. Roentgenologic studies at various time intervals following internal drainage usually fail to reveal filling of the cyst or any abnormality of the gastrointestinal tract at the site of the anastomosis.

Cystojejunostomy is preferable to cystogastrostomy (10) or cystocholecystostomy because of the accessibility of jejunal loops and avoidance of tension on the suture lines. Use of the gall bladder for anastomosis seems to be decidedly unphysiological and is contraindicated in the presence of coexistent biliary disease. A two layer anastomosis is used, and the stoma is made adequate (3 to 4 centimeters).

The question of pancreatitis is to be considered apart from that of cysts, even though it may be a predecessor. The treatment of the acute form is reasonably well established, is conservative, and surgical intervention is indicated only when diagnosis is not well established or upon appearance of a mass. Pancreatic abscess subsequent to acute pancreatitis requires drainage by catheter or marsupialization similar to cysts. Fistula formation can result and the drainage from this type of fistula causes marked skin irritation.

Manifestations of pancreatic insufficiency (hyperglycemia, abnormal glucose tolerance tests, digestive disturbances, and steatorrhea) are reported to accompany pancreatic cysts in relatively few instances. Tests for pancreatic function should be performed routinely and the presence of chronic pancreatitis ascertained. If present, medical management alone is indicated.

The results obtained with internal drainage reported by Adams and Warren, as well as in the 2 cases reported, would seem to compare favorably in morbidity and mortality with other methods of treatment. This is indicated by the satisfactory results which were obtained in each of the 2 reported cases after recurrences had followed previous attempts at external drainage.

SUMMARY

A brief review of the problem of pancreatic cysts is presented.

The frequent association of trauma is stressed as well as antecedent pancreatitis in certain cases.

Methods for treatment are outlined and the merits and disadvantages of each considered.

In the light of recent experience, internal drainage of pancreatic cysts which cannot be totally excised is the method of choice.

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CICATRICIAL CONTRACTURES OF THE THUMB

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CONTRACTURE limiting function of the thumb can occur in any of the surrounding soft tissue structures. However, most motion limiting contractures of the thumb are due to injuries to, or losses of, skin of the palm, thenar eminence, or thumb-index web. It is true that scar tissue may extend deeply but, in most instances, the problem is mainly one of supplying sufficient good skin to allow free motion after the limiting scar has been removed.

In the normal hand the skin is so constructed that it fits snugly when the hand is at rest but can glide or fold to allow motion from this position. When the thumb is in maximum abduction, the palmar skin and that over the thenar eminence are stretched smooth, while the skin between the thumb and index finger is drawn out into a web. On true adduction, the skin of the thenar eminence and adjacent palm folds in accordion fashion in lines parallel to the palmar creases, while the thumb-index web completely reverses from the widely abducted position and becomes relaxed into folds transverse to the line between thumb and index finger. On the motion of opposition-adduction the skin of the thumb-index web, thenar eminence, and adjacent palm becomes one functioning unit, the skin folding in parallel lines radiating outward from a point at the base of the index finger and then curving circularly around the base of the thumb from the proximal phalangeal joint to the cleft between the thenar and hypothenar eminence (Fig. 1).

It is obvious that the ideal replacement of skin over this moving area must be supple, large enough to accommodate to the extremes of motion, and set into the area in a manner which will not allow the formation of restraining scar lines.

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PRINCIPLES OF CORRECTION

In most adduction contractures of the thumb, skin replacement is the key to complete correction. This skin must be set into the hand intelligently if full correction is to be maintained. The skin replaced should join normal skin in line with the natural folds present when the thumb is in adduction or opposition-adduction. No suture line should cross the roughly triangular space formed by the thenar eminence, proximal palmar flexion creases, and the thumb-index web. In addition, the new skin covering should not join the normal skin along the line of the web formed between the abducted thumb and the index finger. This

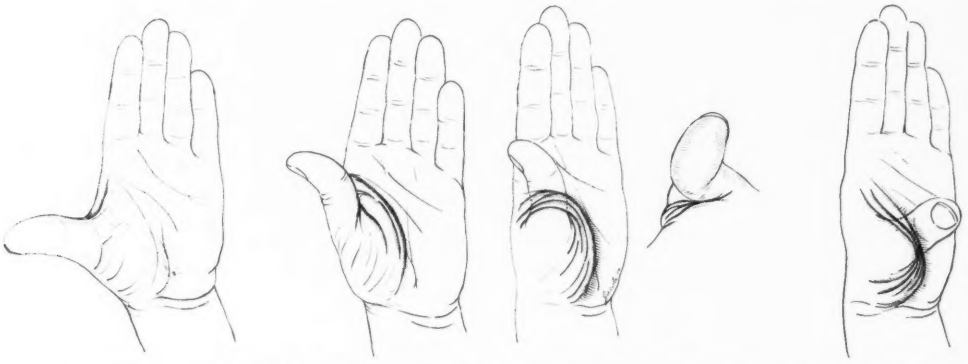

Fig. 1. Schematic drawing made from photographs of normal hand to show the mobility of the skin and the lines of folding which are present when the thumb is in various positions.

mistake is commonly made because most scar contractures of the thumb are primarily due to scarring on only one side of the hand, the other side being unaffected. This is so because most burns and similar injuries of the hands are received in such a manner that one or the other, either dorsal or volar aspect, receives the brunt of the trauma. It should, however, be borne in mind that if the replaced skin is joined to normal skin where the scar excision ends, a suture line will usually fall in the abduction fold between the thumb and index finger. Even though the correction be complete, this scar line will later contract and limit abduction.

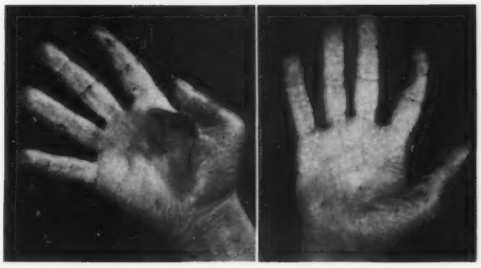

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Fig. 2. a, Scar contracture limiting extension and abduction of the thumb. This occurred following a midline incision made in a primary repair of the flexor tendon. b, Correction by tendon graft, covering tendon with soft tissues, and free full thickness skin graft.

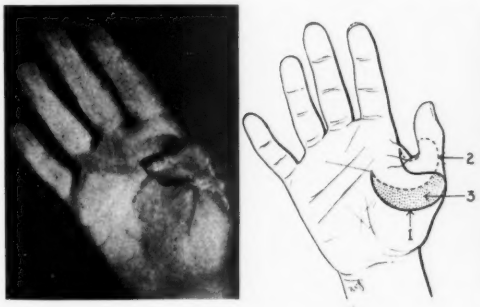
METHODS

There are four possible methods which may be used singly or in combination in the correction of thumb contractures due to scar replacement of lost skin.

1. Transposition of flaps. If there is a thin, well vascularized web between the thumb and index finger, a Z transposition of flaps may be sufficient to deepen the thumb-index cleft satisfactorily. If enough tissue is available, this is an adequate procedure. The suture lines fall within the correct areas and recontracture of the lines of junction are not likely to occur.

Various modifications of Z-plasty are useful in the correction of all scar bridles and it does have some usefulness in relieving thumb contractures. However, this usefulness is limited. It cannot be used when there has been loss and scar replacement of palmar or thenar skin. Even in the correction of thumb-index webs the amount of tissue available for transposition is often insufficient to allow complete alleviation of the contracture. I look upon the Z transposition of flaps in most instances of scar contracture as an adjunct in the correction. They are either used to gain partial correction prior to a planned, more complete operation, or as partial covering of the defect created by complete release, the remaining defect being covered with free skin grafts.

2. Correction by local flaps. It is uncommon that the shift of local flaps is applicable in the correction of scar contractures of the thumb. In deep but limited scars of the central palm which limit abduction of the thumb



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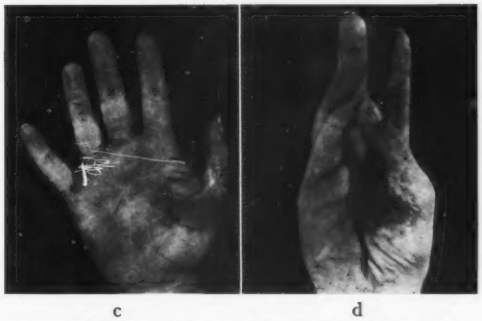
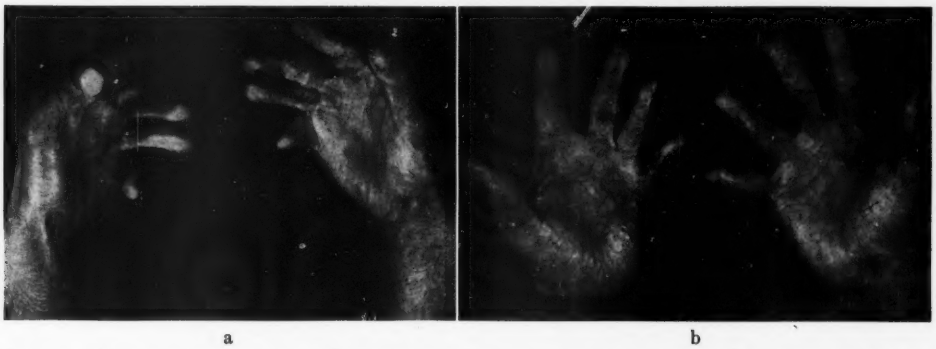


c d

Fig. 3. a, Extreme limitation of extension and abduction due to scar following gunpowder explosion. b, Diagram of local flap shift (*1-2*) and free split thickness skin graft (*3*) to cover area from which flap was taken. c, d, Result. Good skin was shifted into the thumb-index web and over the volar surface of the thumb. This allows good spread without restraining bands between the thumb and index finger and, of course, gets the thumb into opposable position. The line of junction of the graft and flap is, however, incorrect and because of this abduction is limited about 50 per cent. Perhaps the greatest advantage in this type of correction is that it can be done in one step.



a b

Fig. 4. a, Old burn contracture involving fingers and thumb. b, The result from free split skin grafts and utilization of Z flaps 8 years after correction. There has been no appreciable recontracture of the fingers and the palmar grafts stand up under manual labor. The thumbs are in functional position but the grafts were not well placed and hence there has been some circular contraction. This illustrates that the graft edges should cross and not be in line with the lines of function. In this instance a triangle should have gone across the midlateral line on either side.

a b

Fig. 5. a, Adduction contracture of thumb from palmar scarring. Scar caused by third degree burn. b, Right and left hands for comparison, 3 years after excision and release of scar, the defect being covered with a heavy split thickness skin graft. The graft has not contracted appreciably, but the scar line at the junction of graft and skin in the thumb-index web limits abduction. Due to the contraction of this line about 40 per cent of the correction has been lost.

a flap can be shifted from the ulnar side of the hand to cover the vital structures exposed by scar excision. This flap is based proximally and usually includes all the skin and subcutaneous tissues of the hypothenar eminence and extends distally to the base of the ring and little fingers. It is correct in principle and affords a one operation method of correcting limited deep palmar scars.

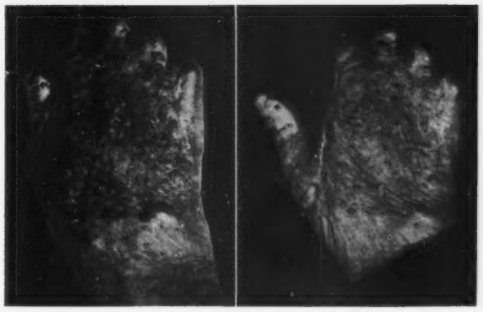
In shifting flaps on the palm of the hand it is rarely advisable or possible to close the defect from which the flap was shifted. The palmar skin is tight and inelastic and does not mobilize easily. The defect is covered with a free skin graft. The maneuver is essentially a shift of the skin and subcutaneous tissue to cover structures over which a free skin graft cannot be safely applied and in so doing a defect which will take a free skin graft is substituted.

In most instances in which release and excision of binding scar expose bone, tendon, or capsular structures of the thumb, a flap can be shifted from the thenar eminence with its base distally over the metacarpal heads of the index and long fingers and a free skin graft can

a Fig. 6. b

Fig. 6. a, Burn scarring of palmar surface both hands, causing flexion contracture of fingers and adduction of the left thumb. b, Various contractures corrected by using small scar flaps and inserting split skin grafts. The fingers have maintained good position but the left thumb contracture has partially returned. In this instance the graft, which was inserted in the palm somewhat correctly, has wrinkled, pigmented, and shortened.

Fig. 7. a, Webbing of thumb and amputation of fingers following severe burn. The condition of both hands was identical. He was so disabled that he had a valet in constant attendance. b, Result following release of scar and resurfacing thumb-index cleft with split skin graft. The graft correctly goes well past the line of pull and folding between index finger and thumb.



a Fig. 7. b

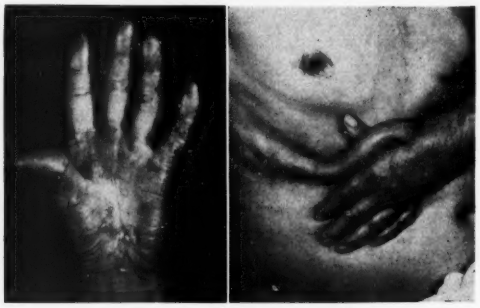
be applied over the thenar eminence. This shift is not as well conceived as the hypothenar flap. Its blood supply is adequate, it provides good covering for the thumb and a satisfactory thumb-index web, but a scar line crosses the palm more or less transversely and does tend to limit wide abduction (Fig. 3). These flaps are useful but should be limited in their application to small areas of deep scarring.

3. Correction by free skin grafts. In perhaps the majority of contractures about the thumb which limit motion, a fairly satisfactory correction results if the scar is cross-cut, dissected free and the skin supplemented with free skin grafts. The possibility of using this method hinges upon whether one thinks the limiting scar is superficial to the deep structures. In the usual burn contracture the scar is superficial enough that a plane of normal tissue is present between the external taut scar and the nerves, vessels, and tendons. When this plane is found, the tight scar gapes and with minimal dissection its edges can be gradually pushed apart. The line in which the scar is severed should be selected with care, with the definite plan of having the edges of the defect so created to coincide with the lines of normal skin folding as nearly as possible. In some instances the scar is actually excised, but in more extensive scarring the defects are created by release of scar tension and insertion of grafts to increase the overall skin area (Fig. 6). Again if possible one must avoid scar lines across the triangular palm area bounded by the thenar eminence and the palmar flexion creases, scar lines in the long axis of the thenar eminence and extended thumb, and between the thumb and the base of the index finger. If the edges of excision coincide with these lines, it is wiser to cross-cut normal skin and insert the graft in circular fashion to avoid the

a b c

Fig. 8.

Fig. 8, d.



a Fig. 9. b

Fig. 8. a, Appearance of severe healed burn in an infant hand. There are three stubs of fingers which are almost completely grown together and contracted into hyperextension. The thumb is healed into the general mass. b, c, d, Scar dissected off dorsum of hand, fingers, and thumb, web resurfaced with heavy split skin grafts. In c, a triangular insert of skin into a cross-cut in the line of normal palmar skin between the base of the index finger and the thumb can be seen. Useful function gained.

Fig. 9. a, Severely contracted palm following an avulsion injury. The thumb is held in pronounced adduction. b, In such injuries it can be anticipated that the scar extends deeply. Its removal will expose the superficial vascular arch, digital nerves, and flexor tendons. This will prevent the use of a free skin graft and in such instances flap repair is mandatory. The tube graft shown in b is first delayed and thinned as a flap. It is further thinned, and tubed at the time of attachment. The attachment to the dorsum of the hand just above the thumb-index cleft allows smooth positioning and draping in the palm. The tube-chest attachment is severed, scar in hand released and excised, flap unfolded, and placed in position at one operation.

possibility of limitation by linear contracture at these vulnerable points (Fig. 7).

Of course, cicatricial contraction limiting thumb motion can occur on either dorsal or palmar aspect of the hand although the majority are mainly palmar. Free skin grafts are more gratifying on the dorsum of the hand. In fact, they are superior to any other method in correcting superficial scar contractures on the dorsum when the deep structures are uninvolved. The dorsal thumb-index cleft can be satisfactorily reconstituted with free grafts if the points mentioned are kept in mind.

In my experience free skin grafts are not as satisfactory in correction of palmar scar contractures. In general the dorsal hand skin is usually in the stretched position when the hand is at rest or grasping. Under the same conditions the palmar skin is relaxed, wrinkled, and folded. This may be the reason that free skin grafts on the dorsal aspect of the hand remain beautifully smooth and eventually almost defy detection while on the palm they often tend to wrinkle and contract.

The character of the skin on the two surfaces is normally different. Free skin grafts

a b

c

Fig. 10. a, Marked adduction of right thumb with minimal visible scar due to electrical burn. Such injuries go deeply. b, Full abduction obtained by correct insertion of flap after scar release and excision. c, The flap has been continued on into good skin to leave skin free of scar between the thumb and index finger.

more nearly resemble dorsal skin since there is normally almost no subcutaneous tissue present. The palmar skin is thicker, tougher, and pretty well padded. Free grafts do not have these characteristics and hence will not stand the hard usage that palmar skin must take at times. In spite of these objections fair to good corrections can be gained and permanently maintained by properly applied thick dermatome type free skin grafts in palmar contracture. The fact that good function of a badly contracted thumb can be gained in one operation in this manner weighs heavily in its favor. Moreover it can be used in children to gain functional position for growth, when flap transfers would be impossible (Fig. 8). If partial recontracture occurs, the operation can be repeated after a year or two with still fewer operative steps than are necessary in correction by flaps.

4. Correction with pedicled flaps. There are a number of things to take into consideration before making the decision to use pedicled flaps in the release of thumb contractures. In general this type of repair gives the best and most permanent correction. Perhaps the most important consideration is the depth of the scar and whether bone, nerve, or tendon repair must be carried out. If the scar is obviously deep, a flap must be used. The necessity for the later repair of deep structures makes a flap replacement necessary.

The location of the restraining scar must be considered. In general free skin grafts are more satisfactory on the dorsum of the hand, flaps on the palmar surface. The age of the patient is important. Infants are poor subjects for the immobilization necessary for a successful flap transfer. Flaps are also more risky in middle aged and elderly patients especially if they are obese. The ideal patient is a young thin male.

The fact that most indications for flap repair are on the palmar surface makes the prob-

lem more difficult since it is an awkward place to use a direct or delayed open flap.

I have gradually evolved the following procedure. If flap repair is mandatory and the patient is in the middle aged, obese or moderately fat group, a flap of sufficient size is outlined on the contralateral lower anterior chest-abdominal wall with its base laterally and its long axis following the rib curve. Its end extends to the midline. About 50 per cent of this flap is elevated, thinned of fat, and delayed. When edema and induration have subsided, the remaining 50 per cent is elevated and thinned. At the third step the flap is completely elevated, tubed, and its medial end attached to the dorsum between the thumb and index finger (Fig. 9). This attachment is left until the tube is soft and edema free. The attachment on the dorsal aspect just behind the thumb-index cleft allows the arm a normal position of right angled elbow flexion and forearm pronation while circulation is becoming established. At the fourth step the tube is severed at the chest, unfolded, and further thinned if necessary, the scar dissected free in the palm, and the flap fitted in place. At the final step after circulation is well established, the dorsally attached end is detached, trimmed, and brought across the thumb-index line. I believe it is important to have the flap thinned to the point where no further intervention in the hand will be necessary thus preventing scarring as much as possible.

CONCLUSIONS

1. In the normal hand the skin of the thumb-index web, thenar eminence, and midpalm is a functioning unit which allows the thumb to move almost as a universal joint.

2. Scar contracture of this region can be relieved by one of four methods:

(a) Z plasty, applicable to thumb-index webs only of rather minor restraining character; (b) local flap shifts, useful occasionally in small deep areas of scar; (c) free skin grafts, most suited to dorsal scars, but giving fair correction in superficial palmar contractures, particularly useful in infants; (d) thinned pedicle flap transfers, for deep palmar scarring and thenar eminence scarring.

3. Any one of the methods must be used intelligently so that no scar lines cross the folding areas of the thumb-index web, thenar eminence, and midpalm if a permanent maximum correction of the contracted thumb is to be obtained.

PEPTIC ULCER FOLLOWING SPLANCHNICECTOMY

A Report of Thirteen Cases

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THE purpose of the present report is to call attention to the effects of splanchnicectomy on the course of peptic ulcer. Since splanchnicectomy deprives the gastrointestinal tract of its sympathetic innervation, this resection can be expected to produce: (a) alterations in visceral sensation and, possibly, (b) alterations in function of the stomach.

Afferent fibers from the gut pass from the sympathetic trunk to the dorsal root by way of the white rami communicantes and, like somatic afferents, their cell bodies are in the dorsal root ganglia. The pathway to the sympathetic trunk runs through the celiac plexus and then goes up through the diaphragm by way of the splanchnic nerves. The greater splanchnic nerve reaches the sympathetic trunk by branches to the fifth through the ninth or tenth thoracic ganglia, the lesser splanchnic usually to the ninth and tenth, and the lowest splanchnic to the last thoracic ganglia or the lesser splanchnic nerve (28). Preganglionic fibers pass outward from the cord by the same pathways. It has been demonstrated by Bain, Irving, and McSwiney (3) that afferent components of the splanchnic nerves enter the spinal cord by way of the white rami communicantes of all the spinal nerves from the third thoracic through the first lumbar. Balchum and Weaver have shown by distending the stomach of dogs with a balloon and watching for a certain typical change of respiration which indicated to them the threshold of pain, that the greater splanchnics carry most of the visceral afferents from the stomach and that the left carries more than the right. Their findings indicate, also, that the distribution of afferent fibers from the stomach enter the cord in a widespread pattern. It was necessary to transect the posterior roots of the fourth thoracic through the third lumbar ganglia before all pain from the stomach was abolished. They suggest further that though, under normal circumstances, the fibers mediating pain in the spinal segments of the eighth thoracic through the thirteenth thoracic ganglia carry the majority of impulses, it is possible that more impulses pass over other pathways when the main routes are interrupted and thus bring the pain threshold more toward the normal level.

The second group of effects of splanchnicectomy on the gastrointestinal tract concerns the alterations in function which might result from the interruption of the sympathetic efferent fibers of the stomach.

That there are alterations in function is suggested by a great many experimental studies. Most of the earliest investigation was centered about the production of peptic ulcers in animals by excision of the celiac ganglia; many of these workers reported lesions of the gastroduodenal mucosa varying from hyperemia to small ulcers. The reader may consult Koennecke for a review of this work.

More recently splanchnic nerve resections on dogs or rabbits were done by Durante, Brancati, Koennecke, and Koga, and they reported that ulcers developed in some of their animals. Alvarez and associates found gastric ulcers after 1 to 5 weeks in 5 of 7 rabbits surviving splanchnicectomy. Lium removed the celiac and mesenteric ganglia from 9 dogs and all of them developed a bloody diarrhea. At autopsy 4 of these dogs had peptic ulcers but Lium considered that inanition due to the diarrhea was partly responsible for the ulcers.

Keller (25) did thoracolumbar sympathectomies on 20 dogs and found no evidence of peptic ulcer when these animals were sacrificed after a postoperative period varying from 1 to 14 days. However, when thoraco-

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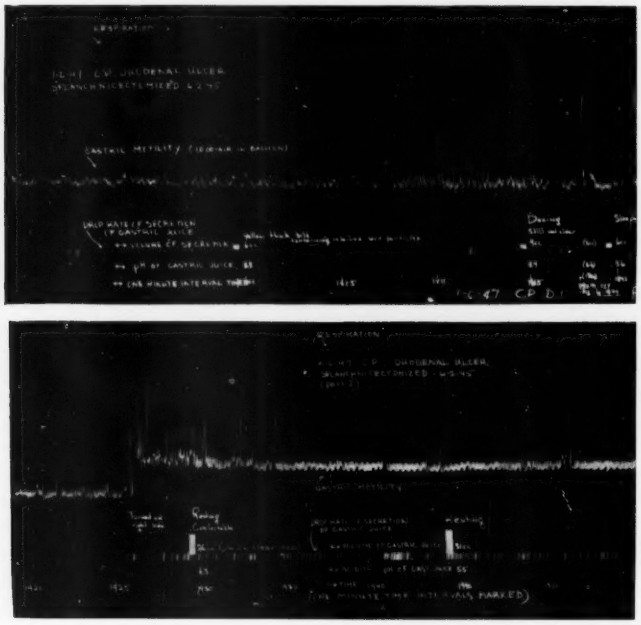
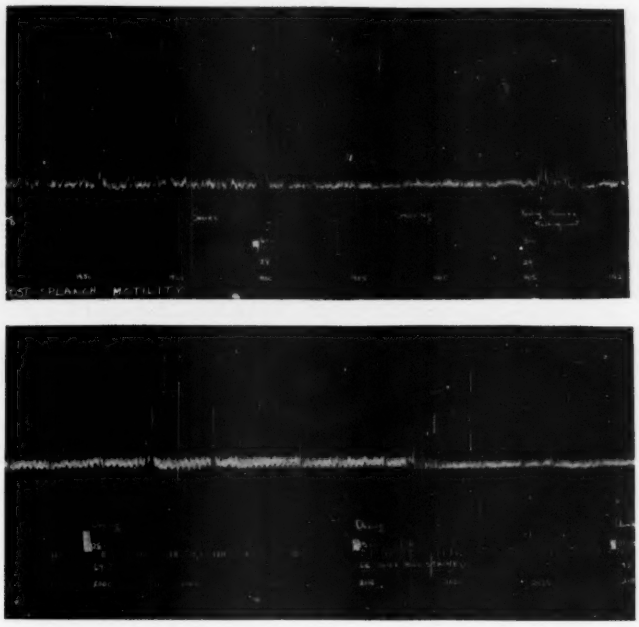


Figs. 1 to 6 (reading across left-hand to right-hand page. This arrangement
is studies, Case 12, begun
Fig. 1. Control study I, Case

lumbar sympathectomy was followed by a destructive hypothalamic operation, ulcers were found in 14 of 29 dogs that survived the second operation for 2 to 9 days. This same hypothalamic operation, when done alone, had produced mostly hemorrhagic lesions of the gastroduodenal mucosa but an occasional small ulcer was also seen (24). When vagotomy was performed instead of sympathectomy on these dogs, no craters appeared.

The study of the physiology of the stomach by other investigators revealed the influence of the sympathetics on the tonus and motility (propulsive movements) of the stomach. While inhibition of motility and decrease of tonus was observed by many workers, stimulation could also be produced, the change in tonus being the most marked result. McCrea and McSwiney (31) concluded that the primary effect of stimulation of the peripheral cut end of the splanchnic nerve could either augment or inhibit, the result being dependent upon the state of tonus of the stomach. Thus, stimulation of a hypertonic stomach produced inhibition while stimulation of a hypotonic stomach produced an augmentation of tonus and, perhaps, some increase in the motility of the stomach. Because of this, they did not regard the sympathetics and vagus as primarily antagonists of each other, but rather each was considered a complete system in itself with its own augmentor and inhibitor fibers, a conclusion similar to that of Nolf.

A correlation of the existing tonus of the stomach and the response of the organ have been observed by other workers: Doyon, Carlson, Boyd and Pearcy (16), Carlson and Litt (17). Brown, McSwiney, and Wadge (13) found that the frequency of stimulation had a marked effect on the result. Low frequency stimulation (1 per sec.) produced contraction while stimulation with a tetanizing current brought about relaxation. Later, Brown and McSwiney (12) found that, under



carried out through Figures 1 to 6). Postsplanchnicectomy balloon kymograph 19 months after operation.
12, carried out January 6, 1947.

the influence of sodium luminal, the inhibitor response which had previously predominated was now converted to an augmentor response, and that current of any strength or frequency would produce only this response.

Bilateral splanchnicectomy has been done on dogs by a number of investigators and the effects on the stomach observed. McCrea (30) did transabdominal splanchnotomies on dogs, cats, and rabbits, and observed the animals for 7 months following. The temporary changes he noted were increased depth of peristalsis and the stomach appeared small and tubular. These gradually became less marked and the organ returned to the normal state. However, permanent changes were noted (by x-ray examination) in the emptying time. The initial emptying time was markedly shortened and there was an appreciable decrease in the total emptying time. This fact he attributed to the increased activity of the stomach. McSwiney (32) tabulated the results of previous workers on splanchnotomy and concluded that it produced accelerated function of the stomach. Cerqua studied the stomach after splanchnotomy and observed a decreased initial emptying time but, in his dogs, the total emptying time returned to normal after a few weeks. However, by following the emptying time by both x-ray examination and by means of gastric fistula, he found that, when olive oil or acid test meals were used, the total emptying time for these was greatly reduced from the expected values. He attributed this fact to a possibly decreased duodenal pyloric reflex. He found no constant change in the intensity or rate of gastric contraction when a balloon was inserted through the fistula so that he attributed the change in the initial emptying time to the presence of a patulous pylorus.

Barron (5, 7, 8) made a long series of balloon kymograph studies in 2 juvenile diabetic patients who had had a two stage splanchnicectomy. Shortly after left splanchnicectomy,

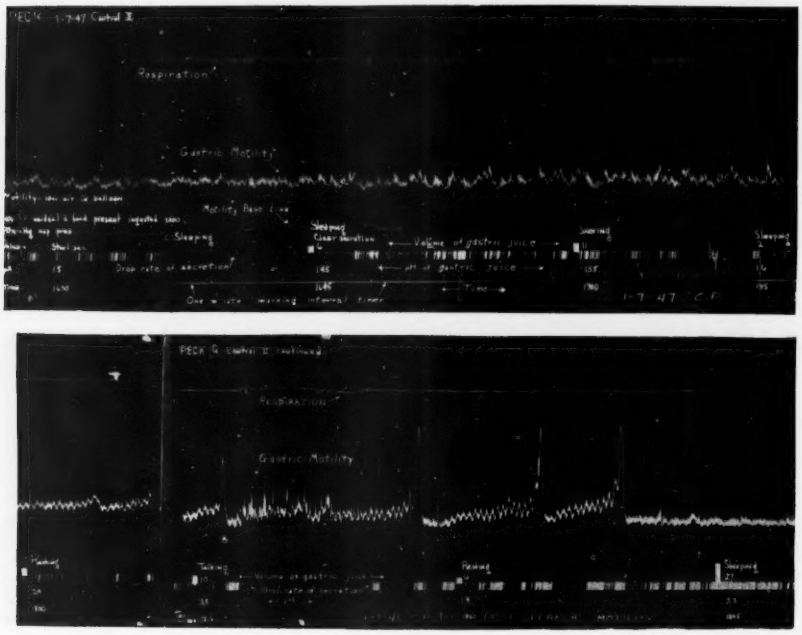
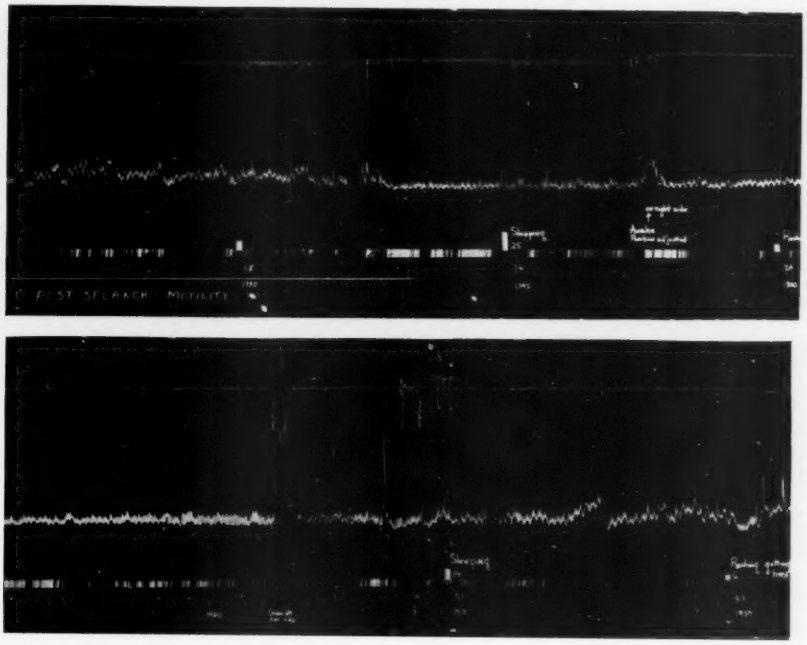


Fig. 2. Control study II, Case

short periods of intense gastric motility were noticed, interrupted by short periods of quiescence. The periods of activity soon became longer and, occasionally, would last throughout a 4 to 5 hour period of observation or, more typically, there would be a period of motility which ended in gastric tetany. After a short period of quiescence the motility would resume and continue throughout the period of observation. After right splanchnicectomy, the results were similar. There was continued prolonged intense gastric motility and this lasted without change for the 7 months that one patient was followed. Gastric emptying time was studied in 1 of these patients and, while no significant decrease was noted after right unilateral splanchnicectomy, the average total emptying time decreased from 4 hours and 45 minutes to 3 hours and 30 minutes following the bilateral splanchnicectomy. Barron (6) concludes that splanchnicectomy removes the inhibitory effect of the sympathetic nervous system, inhibition being its predominant effect, and places the stomach under the unopposed action of the vagus.

From these studies, the change in function, according to the reported work on man and on animals, seems to be in the direction of increased activity of the motor mechanism of the stomach. Whether this change in function is permanent has not been settled by the data in the literature. McCrea (30) acknowledges that the increase in activity seemed to be persistent, but he suggested that it probably would diminish in time. Much more evidence should be accumulated before these points will be established. Barron's 2 patients, it must be remembered, underwent splanchnicectomy for the treatment of diabetes, and though their insulin requirement was found to decrease postoperatively, they still required insulin. Barron states that the blood sugar level was well controlled by careful therapy with insulin and dextrose. But no data on this are given, and the fact that occasional "hypoglycemia periods" were observed and quickly corrected in his patients



12, carried out January 7, 1947.

indicates the need of data which will avoid this possible source of error. Hypoglycemia and the fluctuations in blood sugar resulting from injections of insulin are potent factors connected with the production of gastric motility (14, 36). The 1 hypertensive patient studied after splanchnicectomy in the Gastroenterology Laboratory at the University of Michigan shows no evidence of a hypermotile stomach. Unfortunately, no presplanchnicectomy studies are available on this patient. The postsplanchnicectomy balloon kymograph studies were begun 19 months after operation, shortly after a duodenal ulcer had been demonstrated by x-ray examination. Throughout the following 6 months tracings were made on 5 different occasions. Figure 1 through Figure 6 reproduce representative portions of these records. Throughout all the studies, the degree of quiescence is the most characteristic feature. The periods of activity which usually lasted 20 to 40 minutes consisted of large type I (tonus rhythm) and rather widely spaced type II (single spikes) contractions. As a rule these periods occurred only once during a 3 to 4 hour study, and appeared while the patient was asleep, but somewhat more frequently when the patient was awake. A drop in the *p*H of the gastric juice to below 2.0 or 3.0 usually accompanied this activity. The insulin test, run after 3 control studies, shows the marked and early response of the gastric motility and secretory mechanism to hypoglycemia. The 15 minute samples of gastric juice were titrated and the output of hydrochloric acid during that period recorded—the wide column just above the time line represents the milligrams of hydrochloric acid output; the narrow column, the volume output of gastric juice. On the other records the single column represents the volume output. Despite the relatively small dose of insulin (10 μ) given, a marked subjective response appeared during the hypoglycemic period, and 5 per cent glucose was started by intravenous drip, but not before the stomach had time to respond to the hypoglycemia.

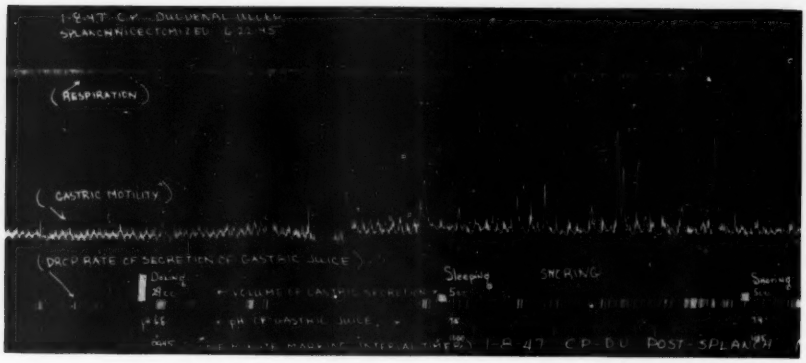


Fig. 3. Control study III, Case

If more studies of this nature, however, bear out the findings of Barron, what role will the increased motor activity play in the production of peptic ulcer, and what of the secretory mechanism under these conditions? Careful, detailed work on this subject might help establish the fact that such a thing as "vagal predominance" does occur when the opposing influence of the splanchnics is removed. And, if under these circumstances, ulcer could be consistently produced in a significant percentage of dogs, the neurogenic theory of production of peptic ulcer would be on a sounder footing.

PRESENTATION OF 13 CASES

Bilateral supradiaphragmatic splanchnicectomy and lower dorsal ganglionectomy was done in these 13 cases as treatment for essential hypertension. Preceding the operation, these patients were studied completely from the standpoint of their hypertension, but for the sake of brevity these findings are not included here. The hypertensive state was of such severity as to overshadow any other condition that was present and, because of this, splanchnicectomy was considered advisable in each case.

A postsplanchnicectomy diagnosis of peptic ulcer was made in 13 of 1,498 patients who registered at University Hospital from June, 1934, to June, 1945, and subsequently underwent a bilateral splanchnicectomy and lower dorsal ganglionectomy at this hospital. Preoperatively, 3 of these 13 patients had a proved diagnosis of peptic ulcer and 4 more had a presumptive diagnosis of ulcer made on the basis of reports of clinical and x-ray

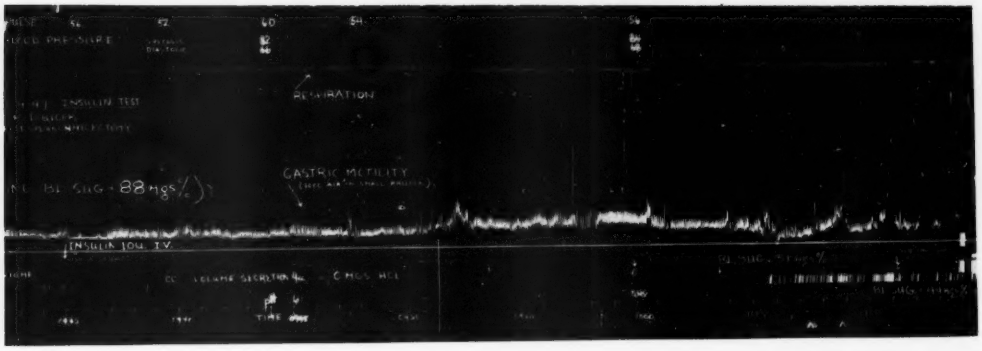
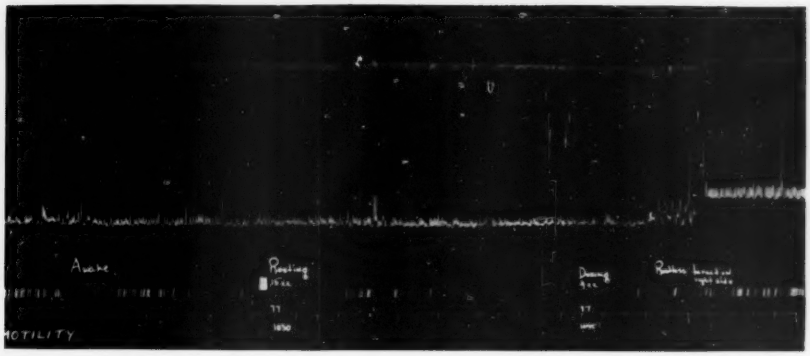


Fig. 4. Insulin test, Case 12.

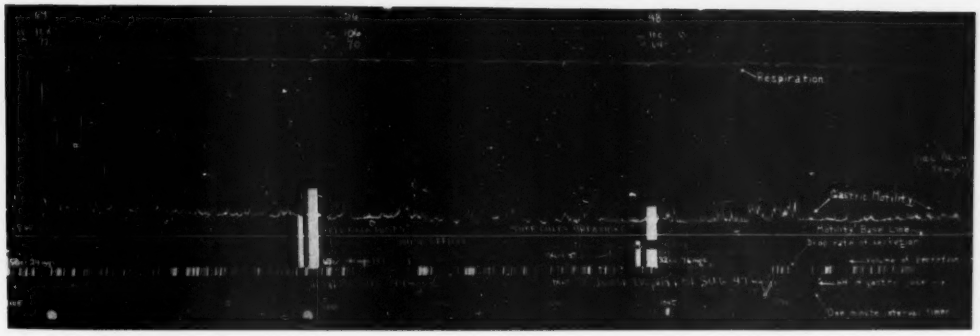


12, carried out January 8, 1947.

findings preceding admission to the University Hospital. An additional 3 patients had symptoms which were only suggestive of ulcer, but, in 1 of these (Case 10) it is extremely likely that an active gastric ulcer was present at the time when the splanchnicectomy was performed.

Postoperatively, the diagnosis of peptic ulcer was proved in 9 cases while a presumptive diagnosis was reached in 3 other instances. In the remaining patient (Case 2), symptoms were suggestive of ulcer but it was not known whether or not the duodenal deformity which was seen 6 years postoperatively represented scarring which occurred before or after splanchnicectomy.

In brief, 8 of these 13 patients developed their first peptic ulcer preoperatively (Case 10 being included) while 4 developed their first ulcer after operation. The remaining patient (Case 2) cannot be placed with any certainty in either of these two groups. In the group of patients who had an ulcer preoperatively, it would not be surprising to find recurrences after operation, considering the nature of peptic ulcer. These recurrences would probably have occurred if any other operation had been done instead of splanchnicectomy or even if the splanchnicectomy had been omitted. With the 4 new cases of peptic ulcer this explanation will obviously not apply. These 4 patients averaged 45 years of age at the time of splanchnicectomy and their first ulcer appeared on an average of less than 2 years postoperatively. One is left to speculate as to whether the psychosomatic response of each of these patients had actually changed during this period from a



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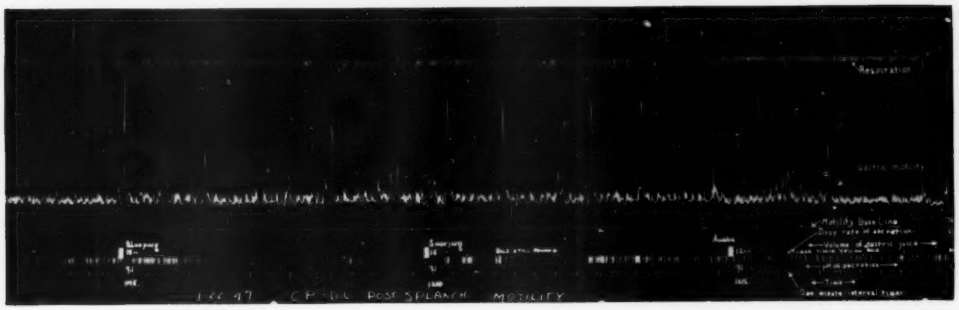


Fig. 5. Follow-up study, Case 12,

hypertensive pattern to one of altered gastrointestinal function or whether the splanchnic resection itself played the important role by upsetting the balance of the autonomic innervation and establishing a vagal predominance. In 1 instance, however, the patient (Case 12) complained of "sour stomach" each spring for 20 years preoperatively, which would suggest that an ulcer diathesis was already present.

In order to get an idea of the over-all frequency of peptic ulcer preceding splanchnicectomy in this large group of hypertension patients, the records of another 200 cases of splanchnicectomy selected at random were reviewed. This group of 200 patients represented a balanced sample of cases, taken from the various services at University Hospital, who had undergone splanchnicectomy during the period from 1934 to early 1948. It was found that in 3 cases a diagnosis of peptic ulcer was proved, and in another case a presumptive diagnosis of peptic ulcer was made on the basis of x-ray findings which the patient reported. Four additional patients reported having a past history of vague gastrointestinal symptoms which were somewhat suggestive of peptic ulcer. Since 2 of the latter patients had negative upper gastrointestinal roentgenograms during a symptomatic period and the other 2 gave a very atypical ulcer history, the evaluation of their symptoms will not be attempted. The 4 patients with a definitely demonstrated ulcer would represent 2 per cent of this group of 200 cases. If this percentage is applied to the entire series of 1,498 cases and a correction made for the 8 patients being reported who had a presplanchnicectomy history of peptic ulcer, the incidence of peptic ulcer before operation would approximate 2½ per cent. On the basis of our data it appears that at least 21 per cent of patients with a presplanchnicectomy history of peptic ulcer will develop another ulcer in the early years following the operation. Since these recurrences

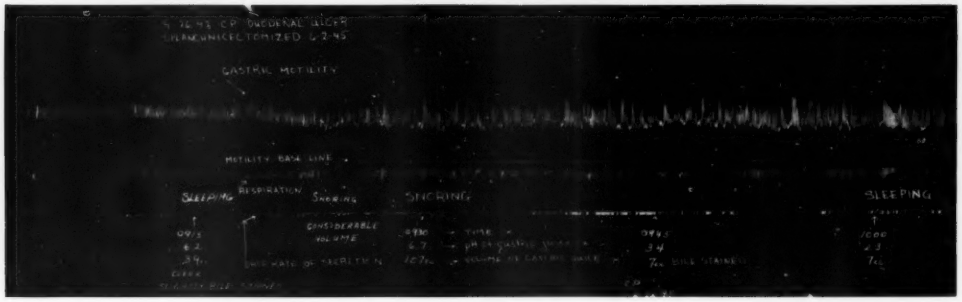
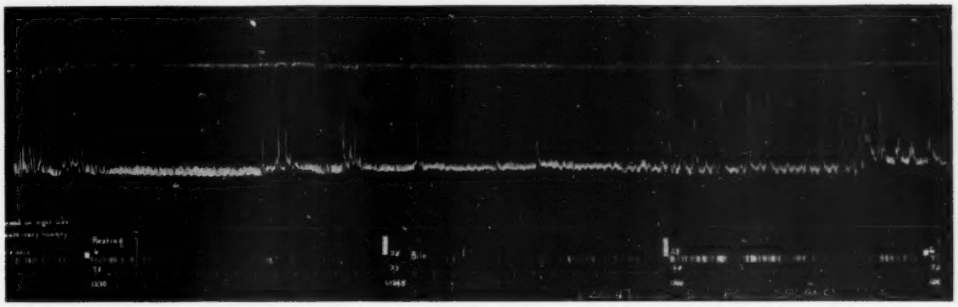


Fig. 6. Follow-up study, Case 12,



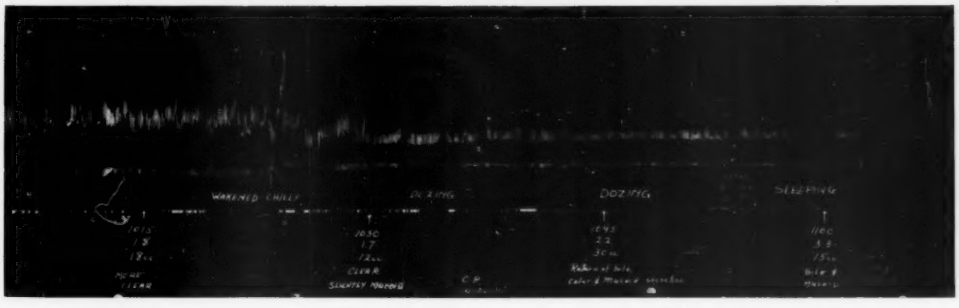
carried out January 22, 1947.

are most likely to be in a silent form, always threatening a serious complication, it would seem wise to handle these patients with peptic ulcer very cautiously after splanchnicectomy.

In both the fatal cases in this series the first ulcer developed following splanchnicectomy, which fact indicates that no individual is free of this threat after operation. The person developing his first ulcer after operation is probably in greater jeopardy because he has had no previous personal experience with peptic ulcer. This factor seems to be the important thing in making patients seek attention when vague signs or symptoms of ulcer do appear, the normal sensations not being present to convince the person of the seriousness of the situation.

COMMENT CONCERNING COMPLICATIONS

Peptic ulcer is so characterized by exacerbations and remissions that we would expect any group of patients with a history of peptic ulcer to have recurrences and develop occasional complications in subsequent years. However, the rate of complication in this group of patients over a postoperative period which averaged 6 years seems much greater than would have been expected if they had not undergone splanchnicectomy. In the group of 8 patients with a preoperative diagnosis of peptic ulcer (Case 10 is included), there had been 2 episodes of hematemesis and 2 other patients had melena preoperatively. By contrast, postoperatively, these same 8 people had 8 episodes of minor bleeding, 1 perforation, 1 partial obstruction, 2 massive hemorrhages, 1 from a penetrating ulcer. In the group of 4 patients that developed their first peptic ulcer postoperatively, 1 had a questionable episode of melena after 2½ years, another had melena and hematemesis after 18 months, followed by a recurrence at 23 months which necessitated a subtotal gastric resection to relieve the obstruction, and 2 died of severe hemorrhage from a duodenal



carried out April 26, 1947.

ulcer 1 year and 4½ years, respectively, after operation.

The lack of normal pain sensation from the upper gastrointestinal tract probably is the main reason why these ulcers reached such serious proportions. As a result, these patients were usually not definitely aware of the ulcer until the onset of a complication. Other factors, however, may also be at work to promote bleeding from the ulcer. These could include the altered motor function of the stomach and duodenum, and the inability of vessels to constrict properly as a result of the removal of the sympathetic nerve supply, or of advancing arteriosclerosis secondary to the hypertension.

Patients who had active ulcers proved to be poor surgical risks. Of the 3 patients (Cases 4, 9, 10) who had possibly active ulcers at the time of operation, 2 had massive hemorrhages soon after operation and both of them required an emergency laparotomy to control the severe bleeding. In Case 10 hemorrhage from a gastric ulcer occurred 9 days after splanchnicectomy. The duodenal ulcer present in Case 4 had shown improvement by x-ray examination month postoperatively; however, 30 days later this ulcer had penetrated into the pancreas and eroded an artery. At laparotomy the duodenum was resected to below the ulcer and then a subtotal gastric resection was done. In Case 9 hemorrhage occurred 9 months postoperatively. This patient had had a duodenal deformity with symptoms of active ulcer which were controlled for 21 days immediately preoperatively by general diet, antacids, belladonna, and phenobarbital. It is unlikely that any other patient in the group of 1,498 was operated on in the presence of an active ulcer since the records were reviewed of all cases of splanchnicectomy in which a diagnosis of peptic ulcer had been made.

Two patients still on medical management for control of symptoms at the time of splanchnicectomy had been symptom free for 2 and 6 months (Cases 3 and 1). The status of their ulcers at the time of operation is conjectural; however, they were not able to tolerate a general diet and withholding of antacids. These 2 patients hemorrhaged 2 and 6 months postoperatively, respectively The patient (Case 7), who had the perforated duodenal ulcer 9 months postoperatively, fits into neither of these groups. He had been free of ulcer symptoms for 2 years at the time of splanchnicectomy, but his was one of the 2 longest ulcer histories in this series of cases; only 1 patient (Case 9) had a longer history.

It would seem that the presence of a recent ulcer and also of an ulcer of long standing constitutes an indication for extreme care in the postsplanchnicectomy management. The patients with long ulcer history in this series were also those who were found most consistently and repeatedly to develop the more severe complications of ulcer after the splanchnicectomy.

In the 2 fatalities (Cases 5 and 13) in this series, however, there was no history of gastrointestinal disorder preoperatively. It was not until 10 months after operation that abdominal symptoms appeared in Case 13. At this time there was severe abdominal pain and vomiting which persisted for several days, but this subsided with bed rest and the patient felt quite well for the next 6 or 7 weeks. The fatal hemorrhage occurred suddenly 1 year postoperatively while the patient was complaining only of a severe pain in the right leg. The autopsy demonstrated an ulcer in the first portion of the duodenum which had penetrated into the pancreas and eroded a good sized artery. Case 5 had at least 3 episodes of rather severe hemorrhage, the first occurring 29 months after splanchnicectomy. These presumably were from a peptic ulcer though no roentgenograms were ever taken and no abdominal pain of any kind was mentioned. The fatal hemorrhage occurred 4½ years postoperatively and at autopsy a large bleeding duodenal ulcer was found.

Recently, 2 cases of peptic ulcer following thoracolumbar sympathectomy for hypertension have been reported (10, 38). Both patients had a long history of peptic ulcer and, in addition, both had an active ulcer at the time of operation. One of these patients died with a perforated duodenal ulcer on the sixteenth postoperative day (a vagotomy had

been done 1 month previously), and the other had a radical subtotal gastric resection 5 months after sympathectomy because of recurrent severe hemorrhages from a prepyloric ulcer. Mention has been made (33) of 3 other patients who bled massively and painlessly from a duodenal ulcer following splanchnic resection. One patient succumbed to the hemorrhage.

European investigators (1, 21, 22, 37) have reported cases in which unilateral or bilateral splanchnicectomy was done in the presence of active peptic ulcer as a form of treatment. Two-thirds of these operations were only unilateral in extent and thus not really comparable to the cases discussed in this report because the visceral sensation was not completely removed by this procedure (9). Seven of their patients, however, had a bilateral splanchnicectomy and 4 of these also had the first and second lumbar ganglia removed. Five of these bilateral resections were done by Sicard and associates and this method of treatment was considered a failure by them, but they fail to mention the postoperative complications which very likely developed since 3 of their patients finally required subtotal gastrectomy. In none of these 7 patients did the ulcer crater completely disappear following splanchnicectomy during a period of observation varying from 3 months to 2 years and 9 months.

COMMENT CONCERNING PAIN

The absence of typical pain is intimately associated with, if not the sole cause of, the serious complications discussed in this paper. Very few of these complications would have resulted if the normal pain pathways from the gut were intact. Because of the importance of this pain factor, the records of these patients were screened carefully for every mention of pain.

Two main groups of pain seem to set themselves off naturally. One group, appearing immediately postoperatively, undoubtedly represents pain incident to the trauma of the surgical procedure, to the anesthetic, to functional ileus. Nevertheless, a pathway to consciousness must be present. The second natural grouping includes all pain that was mentioned after the immediate convalescence from the operation. These pains may be classified as severe and otherwise. The severe pains were quite obvious in the records, mostly because of their rarity but, also, because they could be described more accurately by the patients. In the 3 instances that severe abdominal pain occurred, it indicated a serious complication: a perforated duodenal ulcer in 1 case, which caused a constant severe pain in the right epigastrium, accentuated by breathing and doubling the patient up because of its severity; in the other 2 cases, a duodenal ulcer which was penetrating into the pancreas. This caused a rather severe cramping epigastric pain for only 15 to 20 minutes in one of the patients while in the other there was severe abdominal pain and vomiting for several days about 2 months before the fatal hemorrhage occurred. Only pain in the right leg was present at the time of death.

The less severe pains of all varieties, despite the hopelessness of trying to attach significance to pains which are recorded more or less perfunctorily, are important insofar as they might allow some evaluation of the completeness of the resection of the visceral afferent fibers in these cases. There were many variations in the amount of the sympathetic nervous system removed. The most frequent operation consisted of a removal of a large segment of both greater and lesser splanchnic nerves and the excision of the tenth, eleventh, and twelfth sympathetic ganglia. In none of the cases was any lumbar ganglia removed.

The possible pathways to consciousness can be mentioned briefly: (1) There are visceral afferent fibers in the vagus but it is generally believed that vagal impulses do not reach consciousness (15, 34). However, impulses which result in the sensation of nausea may be mediated by the vagus. (2) Pain from the parietal peritoneum does not travel in the visceral pain tracts but rather it reaches the spinal cord by way of the peripheral nerves (28). The severe pain following perforation in 1 case, and penetration into the pancreas in the other 2 could have followed this pathway though a localization of the

pain more in the region of the back might be expected with stimulation of these pain receptors. (3) According to the segmental distribution of the nervous system, visceral pain from lower portions of the bowel would enter the spinal cord at a lower level and it is more likely that some of their afferents would pass into the lumbar segments of the cord. If the lumbar sympathetic ganglia are left intact, pain impulses resulting from spasm of the lower gastrointestinal tract or even from distention could readily reach the cord as either a referred or a direct visceral pain and would be experienced by the patient. (4) The possibility of visceral pain from the stomach itself would necessitate a widespread distribution in the cord of the visceral afferent fibers from the stomach. The work of Balchum and Weaver in dogs suggests this as a possibility. They had to section posterior roots of the fourth thoracic through the third lumbar ganglia before they could completely eliminate response to distention of the stomach. If this is also true in humans, then the leaving of the lumbar ganglia undisturbed should permit a certain amount of visceral sensation from the stomach and duodenum to persist.

The comparison of patients who have had splanchnicectomy and lower dorsal ganglionectomy with those who have had a thoracolumbar sympathectomy should help to clarify this point and epigastric pain should be the best indication of this persistence. Jones has shown by balloon distention of various portions of the upper gastrointestinal tract that, as the balloon is successively advanced and redistended, the pain is referred to a point progressively lower in the abdomen, but always somewhere near the midline. When the stomach or the duodenum was distended, sharply localized pain in the midepigastrium was obtained in most cases.

In the examination of the pain noted immediately postoperatively, we find that in only 2 cases was epigastric pain mentioned. It was present on only 1 day in each case, this day being soon after operation on the first postoperative day in Case 4, and on the second postoperative day in Case 10. Oddly enough, both these patients soon had a serious complication and required immediate laparotomy. One patient (Case 1) complained of epigastric distress during the seventh postoperative day. This was relieved by initial ulcer diet and Sippy tablets. Various abdominal pains are reported, most of these being in the right lower quadrant or right upper quadrant when localization is mentioned. The thing most frequently associated with these pains is distention, and this could probably explain away a good share of the early postoperative pains. The pain could originate in the lower bowel (the portion with afferents to the lumbar segments of the cord) either by distention of this part or pressure on this part by distention in another part of the bowel. Distention, in addition, can cause tugging on adhesions and send painful sensations from the parietal peritoneum. Perhaps the frequent localization in the right upper quadrant and right lower quadrant is due to the presence there of adhesions from old inflammatory processes. From our data it is evident that nausea is not unusual after splanchnicectomy.

In examining the pains mentioned in the later postoperative course of the 8 patients who had abdominal symptoms with their ulcers, it was noted that 5 complained of some kind of vague epigastric sensation, variously described as discomfort, distress, soreness, fullness, pressure, burning or dull ache. Of the other 8 patients, 1 had had a partial gastrectomy (Case 4), 4 made no mention of pain, 1 patient experienced only nausea and vomiting with his ulcer (Case 12), and 1 had a single instance of pain in the abdomen which lasted for several days, 2 months before death. Tenderness of some degree was noted in 4 of the 8 patients with symptoms. In all the patients the typical midepigastric pain of peptic ulcer was absent. However, the presence of a vague type of epigastric distress suggests that some sensation directly from the stomach and duodenum still remained intact. Ulcer management (diet and antacids) effectively eliminated these complaints. Assuming that the stimulation of peripheral nerves and visceral afferents in lower bowel would give a localization other than epigastric, there yet remains the vagus. Can visceral sensation reach consciousness by way of the vagus? A study of

abdominal pain present after more extensive resections of the sympathetic nervous system than have been done at this hospital should provide important evidence in answering this question.

SUMMARY

In a group of 1,498 patients who underwent a splanchnicectomy for hypertension during an 11 year period, there were 13 cases of peptic ulcer following the operation. Three of these had proved ulcers preoperatively; while in 4 a presumptive diagnosis of ulcer was made, and in 3 others symptoms which were suggestive of peptic ulcer were present. Postoperatively an ulcer was demonstrated in 9 cases and a presumptive diagnosis was made in 3 other patients. In 1 instance there were only suggestive symptoms of peptic ulcer both before and after operation and it was not known whether the scarring of the duodenum seen 6 years postoperatively had been present before splanchnicectomy.

Approximately 2½ per cent of the entire group of 1,498 patients were considered to have a definite preoperative history of peptic ulcer and 21 per cent of these reported a recurrence following splanchnicectomy.

Preoperatively only 4 patients had a complication of their ulcer. In each case this complication was hemorrhage and it was usually of no great severity. By contrast, 11 of the 12 ulcers which appeared after splanchnicectomy were complicated. It was frequently only by this complication that the ulcer definitely announced its presence. Five of these patients had severe complications; 2 were fatal and the other 3 required emergency laparotomy. One of these was for the closure of a perforation; the other 2 were necessary to ligate arterial bleeders in the base of the ulcer. Of the latter 2 patients, one had an active ulcer at the time of splanchnicectomy and the other probably also had one.

It seems clear that, following splanchnicectomy, frequent and severe complications of peptic ulcer developed in these 12 patients because the normal epigastric pain sensations were either abolished or greatly reduced so that the ulcers were permitted to advance to dangerous proportions without giving the usual warning. Whether the splanchnicectomy, itself, caused the ulcers or not cannot be concluded from the findings presented; however, 4 patients developed their first ulcer postoperatively and 2 of these resulted in fatal hemorrhages. The patients with the longest history of peptic ulcer before operation usually developed the more serious complications. Patients with recently healed ulcers, and especially patients with active ulcers, developed complications most rapidly after splanchnicectomy, and these complications were among the most severe that were present in this group of patients.

Epigastric pain was present immediately after splanchnicectomy in 2 patients, and in both of these severe complications finally developed. Vague epigastric distress months to years postoperatively was noted by 5 of the 8 patients in whom mention of abdominal symptomatology was made. Severe pain was described by 3 of the patients and this appeared as the ulcer was penetrating or perforating. It is felt that more attention should be paid to vague abdominal signs and symptomatology following splanchnicectomy. Prompt diagnosis and rigid medical management in these cases would reduce the frequency of complication when peptic ulcer is present.

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THE SIGNIFICANCE OF AN ULCERATING LESION IN THE STOMACH FOLLOWING GASTROENTEROSTOMY

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THE development of an ulcerating lesion in the stomach after gastroenterostomy is not uncommon, and yet we have been unable to find any reports in the medical literature in which such lesions have been discussed. For this reason and because we had the distinct impression that the incidence of malignancy was high for gastric lesions that developed after gastroenterostomy, it seemed worth while to review in detail all those cases at the Mayo Clinic during the 10 year period from January 1, 1938, through December 31, 1947, in which a gastric lesion requiring surgical intervention developed subsequent to gastroenterostomy for duodenal or gastric ulcer.

This series of patients does not include every patient in whom a gastric lesion was demonstrated after gastroenterostomy, for many patients were seen at the clinic during this period who declined operation, who were operated on subsequently elsewhere or who were treated conservatively. This study does include all those patients in whom a demonstrable gastric lesion followed gastroenterostomy and who underwent surgical treatment, including discontinuance of the original gastroenteric stoma and partial gastrectomy.

It has been accepted generally that the coexistence of an active duodenal ulcer and a gastric cancer is very rare. The high gastric acidity and the increased peptic activity that are associated with an active duodenal ulcer seem to prohibit or delay the development of a malignant neoplasm in the stomach, as suggested by Wilbur and Rivers. Bockus has stated that "patients with this disease (duodenal ulcer) are much less likely to develop cancer of the stomach than those who have no stomach disease whatever." Eusterman and Balfour have expressed the opinion that "the presence of duodenal ulcer is in a certain sense an insurance against carcinoma of the stomach." They reported that of 15,985 patients who underwent roentgenologic examination of the stomach for digestive disturbance, 2,047 (12.8 per cent) demonstrated deformities of the duodenal cap which were characteristic of duodenal ulcer, 167 (1 per cent) had roentgenologic evidence of gastric ulcer, 24 (0.15 per cent) showed evidence of both duodenal and gastric ulcer, and in none was there evidence of a duodenal ulcer which was associated with what was apparently a malignant lesion in the stomach.

In 9,171 consecutive postmortem examinations at the Cook County Hospital, Portis and Jaffé found 240 benign gastric ulcers, 215 duodenal ulcers, 19 benign gastric ulcers associated with a duodenal ulcer, but in no patient did they find a duodenal ulcer associated with a gastric carcinoma. Smithies and Ochsner, however, have reported on 12 patients in whom gastric cancer was coexistent with benign peptic ulcer, in 8 of whom the peptic ulcer was located in the duodenum. Wilbur and Rivers in 1932 reported on 33 patients who had duodenal ulcer associated with gastric cancer. Four of these patients had undergone a previous gastroenterostomy for duodenal ulcer. In 20 of the 33 patients the gastric lesion was a malignant ulcer, whereas in the remaining 13 patients a massive gastric carcinoma was found. In all of the 33 patients the nature of the lesion was proved at operation or necropsy.

Fischer, Clagett, and McDonald found records of only 48 cases of coexistent duodenal ulcer and gastric cancer in the surgical and postmortem files of the Mayo Clinic from 1911 through 1944. In only 1 of those 48 patients had a previous gastroenteric stoma been made for duodenal ulcer. During this same period of 34 years, there were approximately 600 instances in which a coexistent duodenal and a benign gastric ulcer were seen on roentgeno-

From the Division of Surgery, Mayo Clinic and Mayo Foundation.

TABLE I.—GASTRIC LESIONS FOLLOWING GASTROENTEROSTOMY 1938–1947 (INCLUSIVE)

Year	Gastroenteric stomas disconnected and partial gastrectomy done	Gastric lesions following gastroenterostomy for					
		Duodenal ulcer		Gastric ulcer		Other reasons	
		Benign	Malignant	Benign	Malignant	Benign	Malignant
1947	65	5	1	0	0	0	0
1946	98	3	2	0	1	0	0
1945	100	0	1	1	1	0	0
1944	87	3	0	1	0	0	0
1943	79	4	2	0	1	0	0
1942	76	4	3	1	0	0	0
1941	82	2	1	0	1	0	1
1940	76	4	1	2	1	0	0
1939	81	4	0	0	1	0	0
1938	81	1	0	0	0	0	0
Total	825	30	11	5	6	0	1
Percentage benign or malignant		73	27	45	55	Insignificant	Insignificant

logic examination at the clinic. The association of a duodenal ulcer and a benign gastric ulcer appears therefore to be about 12 times as common as the association of a duodenal ulcer and a gastric carcinoma (a ratio of 600:48 in approximately 45,000 patients).

There were 825 patients seen at the clinic during the 10 year period between January 1, 1938, and December 31, 1947, in whom a previously established gastroenteric stoma for duodenal or gastric ulcer had to be discontinued owing to subsequent complications and for whom a partial gastrectomy was carried out as a secondary procedure. These subsequent complications which followed the original gastroenterostomy and for which surgical treatment was advised included jejunal ulceration near the gastroenteric stoma, malfunctioning gastroenteric stoma, gastric ulcer and gastric carcinoma, listed in order of their incidence. In Table I may be seen the relative incidence of benign and malignant lesions in this series of patients.

Forty-one gastric lesions developed after a gastroenterostomy for duodenal ulcer, of which 11 (27 per cent) were gastric cancers and 30 (73 per cent) were benign gastric ulcers. The association of an old duodenal ulcer with subsequent gastric cancer in a stomach that has undergone gastroenterostomy appears to be more common perhaps than one would think in view of the few cases on record in which this association has been found in routine studies of patients not subjected to previous gastric operations. Of 11 gastric lesions that developed or were retained after a gastroenterostomy for gastric ulcer, 6 (55 per cent) were proved to be malignant and 5 (45 per cent) were proved to be a benign gastric ulcer at the time of the subsequent gastric resection. Included in this study was 1 patient in whom a gastroenteric stoma had been made elsewhere for no demonstrable ulcer and in whom a gastric carcinoma that required surgical intervention developed several years later.

In the routine study of patients who are examined roentgenologically on account of gastric complaints, the ratio of gastric ulcer to gastric carcinoma has been found to be about 1:3 at the clinic (2). In our small series of 53 patients in whom a previous gastroenteric stoma had been made for duodenal or gastric ulcers (in all instances except 1), the ratio of gastric ulcer to gastric cancer is almost reversed, being 2:1 (35:18). It appears that a patient with an ulcer diathesis is less likely to have gastric carcinoma.

GASTRIC LESIONS THAT FOLLOWED GASTROENTEROSTOMY FOR DUODENAL ULCER

Of the 41 patients in this group, 30 had benign gastric ulcers and 11 had gastric cancers that followed previous gastroenterostomy for duodenal ulcer.

Of the 30 patients in whom benign gastric ulcers developed, 12 had undergone gastroenterostomy at the clinic. The average age of these patients at the time of gastroenterostomy was 39.3 years and at the time of the subsequent gastric resection 52.3 years, thus giving an average time interval of 13.0 years between these 2 operations.

Of the 11 patients in whom carcinoma developed, 2 had undergone gastroenterostomy at the clinic. The average age of these patients at the first operation was 35.9 years and at the second 50.9 years, an average time interval of 15.0 years between these 2 operations.

Symptoms. In the group with benign gastric lesions, all patients complained of distress which was characteristic of peptic ulcer. In the group with malignant gastric lesions, 5 of the 11 patients gave a definite history which strongly suggested peptic ulcer, 2 presented a less clear-cut history, 1 gave no characteristic story, and 3, on the other hand, presented a history pointing toward malignancy, that is, anorexia, progressive weakness, loss of weight and so forth. The average loss was 8.5 pounds (3.8 kgm.) for the patients with benign lesions and 16.5 pounds (7.5 kgm.) for those with malignant lesions.

Clinical findings. The value of free hydrochloric acid in the gastric contents averaged 25.6 units in the patient with benign lesions. It was absent in 3 (10 per cent) of this group, but 1 patient had a gastrojejunocolic fistula and another had a gastroileac stoma, which had been made elsewhere, so that the apparent achlorhydria could be accounted for in 2 of the 3 patients. The value for free hydrochloric acid averaged only 9 units for the 8 patients with malignant lesions for whom it was determined, and free acid was entirely absent in 4 (50 per cent). The quantity of hemoglobin averaged 12.6 grams per 100 cubic centimeters of blood for patients with benign lesions and 11.8 grams for those with malignant lesions.

Roentgenologic findings. In the group of patients with benign lesions the roentgenographic diagnosis was "gastric ulcer" in 20 (67 per cent), "gastroenteric stoma free" in 6, "gastrojejunocolic fistula" in 2, "obstruction" in 1, and no examination was done in 1 who was bleeding. In patients with malignant lesions the roentgenographic diagnosis was "carcinoma" in 5 (45 per cent), "ulcerating lesion" in 4, "gastrojejunitis" in 1, and "obstruction" in 1.

Comment. The benignancy of the gastric lesion was suggested frequently by the patient's symptoms and by the clinical findings; a gastric carcinoma was concealed and was revealed only at the time of operation. The clinical diagnosis was difficult in those patients who harbored malignant lesions of the stomach in the presence of an old gastroenteric stoma and an old duodenal ulcer. In 2 of these patients the preoperative clinical impression was "gastric ulcer," in 2 "malfunctioning gastroenteric stoma," and in 3 "stomach ulcer," but at operation they were all found to have carcinoma of the stomach. The 3 case reports which follow illustrate how frequently a malignant gastric lesion in a stomach that has undergone gastroenterostomy can simulate a benign condition.

"Gastric ulcer" was the clinical impression in the following 2 patients in whom a malignant gastric lesion was found at operation.

A male, aged 36 years, gave a history of epigastric pain and vomiting for 1 year. Thirteen years previously he had undergone gastroenterostomy elsewhere for duodenal ulcer. The roentgenographic examination revealed an "ulcer on the lesser curvature below the angle, associated with diffuse gastritis." The free hydrochloric acid in the gastric contents measured 38 units, and the total acids measured 48 units after the usual test meal. At operation a scirrhous, colloid, grade 4 adenocarcinoma (Broders' method), arising on the lesser curvature 3 centimeters above the pylorus, was found. The tumor, which measured 7 by 5 by 2 centimeters, already had invaded the serosa and regional lymph nodes of the stomach. A partial gastrectomy was carried out, but the patient survived only 6 months after operation. The carcinoma was 5 to 6 centimeters from the gastroenteric stoma (Fig. 1).

A male, aged 56 years, had a gastroenterostomy performed for a subacute perforating duodenal ulcer 29 years previously at the clinic. Symptoms referable to the stomach had recurred only 1 month prior to his present admission and consisted of diffuse upper abdominal and lower thoracic pain associated with some fatigue. The diagnosis, by means of roentgenography, was "large ulcer on the lesser curvature, just below the angle, associated with extensive gastritis." The quantity of free and total acids in the gastric contents was not determined. A rigid regimen of medical management was instituted in the hospital and within 11 days his subjective symptoms had disappeared. Surgical treatment was advised, however, and at operation an extensive, grade 4 colloid adenocarcinoma, involving the lesser curvature with spread to the serosa and regional lymph nodes, was found. The lesion was of the linitis plastica type and demonstrated only a small area of mucosal ulceration. The patient died 12 months after a partial gastrectomy was done.

"Stomal ulcer" was the clinical impression in the following patient who was found to have a malignant lesion at operation.

A male, aged 40 years, had had a gastroenterostomy for duodenal ulcer 22 years previously. Symptoms referable to the stomach, consisting of high abdominal distress which was consistent with peptic

TABLE II.—PATHOLOGY OF CARCINOMA OF STOMACH FOLLOWING GASTROENTEROSTOMY FOR DUODENAL ULCER

Gross description	Number	Size, cm.	Grade (Broders')	Type (Dukes')
Ulcer type	5	3x3x2	2	C
		5x5x0.5*	4	A
		5x5x1.5	2	C
		9x6x2	4	C
		3.5x4.3x1.2	4	C
Massive growth	3	7x5x2	4	C
		6x6x1.5	4	–
		7x10	4	C
Linitis plastica	2	10x9x2	2	C
		"Large"	4	C
Polypoid type	1	5x4x1	3	B
Total	11		3-grade 2	1-A
			1-grade 3	1-B
			7-grade 4	8-C

*Thought to be a benign ulcer at operation.

ulcer, had recurred 9 years prior to his present admission, and during the last 4 years his pain had become gradually more severe. He had lost 20 pounds (9.1 kgm.). The quantity of free hydrochloric acid in the gastric contents was not determined but roentgenographic examination revealed an "ulcer high on the lesser curvature of the stomach, associated with extensive hypertrophic gastritis." At operation a grade 4 ulcerating, mucous adenocarcinoma was found on the lesser curvature near the angle. It was a superficial lesion, measuring 5 by 5 by 0.5 centimeter and fortunately the serosa and regional lymph nodes showed no evidence of invasion. The carcinoma was about 4 centimeters above the gastroenteric stoma (Fig. 2).

Pathologic features. In the group of patients with benign lesions, the ulcers averaged 1.5 to 2.0 centimeters in diameter and none measured over 3.5 centimeters. A microscopic diagnosis of benign gastric ulcer was made in each instance. All the old duodenal ulcers were either healed or entirely inactive at the time of the second operation.

Of the 11 patients with malignant lesions, 5 had gross ulcerating lesions, 3 had massive carcinomas, 2 had diffuse carcinomas of the linitis plastica type with involvement of the entire thickness of the gastric wall, and 1 had a polypoid carcinoma (Table II). Most of these lesions were of high grade (Broders' classification) and 7 (64 per cent) were classified as grade 4 carcinomas. Invasion of the serosa and regional lymph nodes had occurred in 8 (73 per cent). It is interesting to note that of the 5 malignant ulcers, 4 measured 5 centimeters or less in diameter. One of these was thought to be a benign gastric ulcer until it was examined microscopically by the pathologists and found to be a superficial mucous adenocarcinoma, grade 4.

GASTRIC LESIONS THAT FOLLOWED GASTROENTEROSTOMY FOR GASTRIC ULCER

Of the 11 patients in whom gastric lesions developed after gastroenterostomy for gastric ulcer, in 5 the lesions were benign gastric ulcers, but in 6 they were malignant neoplasms.

Of the 5 patients in whom a benign gastric ulcer was found, 2 had had a previous gastroenterostomy at the clinic. In these 2 and in 1 other patient, local excision of the gastric ulcer was carried out concurrently with the gastroenterostomy. The average age of the patients at the time of the second operation was 57.8 years. The average time interval subsequent to the gastroenterostomy was 17.0 years.

Of the 6 patients in whom a malignant neoplasm was found, 2 had had their gastroenterostomy at the clinic. The average age of the patients at the time of gastrectomy was 51.0 years, and the average time interval between the gastroenterostomy and the second operation was only 6.0 years. In 5 patients this time interval was 2 years or less. It is significant to note that in no instance was a biopsy or local excision of the gastric ulcer done in this group at the same time that gastroenterostomy was performed.

Symptoms. Of the 5 patients who had a benign gastric ulcer, all gave a history that was quite characteristic of peptic ulcer, but of the 6 patients who had a malignant lesion, only 3 gave a history suggesting peptic ulcer, whereas 1 gave a less definite history of ulcer and 2 gave a history which was not suggestive of peptic ulcer. The average loss of weight prior to admission to the clinic was 9.8 pounds (4.4 kgm.) for the patients with benign lesions and 22.5 pounds (10.2 kgm.) for those with malignant lesions.

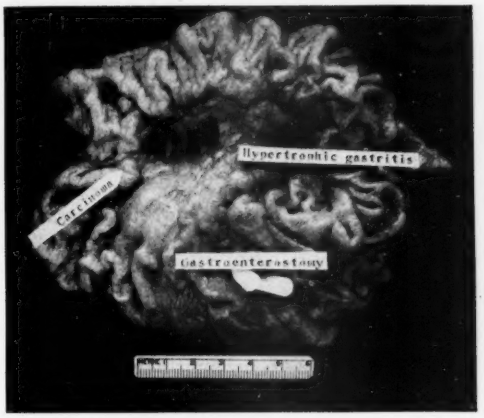

Fig. 1. Ulcerating grade 4 mucus-producing adenocarcinoma on the lesser curvature of the stomach. A gastroenteric stoma for duodenal ulcer had been made 13 years previously.

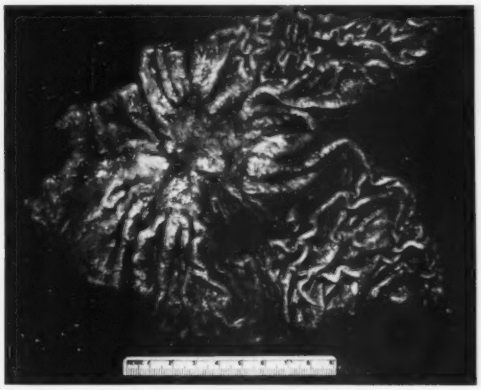

Fig. 2. Superficial grade 4 ulcerating mucous adenocarcinoma on the lesser curvature and posterior wall of the stomach. A gastroenteric stoma for duodenal ulcer had been made 22 years previously.

Clinical findings. The quantity of free hydrochloric acid in the gastric contents ranged from 26 to 50 units in the group of patients with benign ulcers. It was also present in 3 of the 6 patients with gastric cancer, the quantity ranging from 14 to 36 units.

Roentgenologic findings. In the 5 patients with benign lesions, the roentgenographic diagnosis was "gastric ulcer" in 4 and "deformity" of the gastric wall in the remaining 1, who actually had scarring of the wall from a previously excised gastric ulcer. In the 6 patients with malignant lesions, the diagnosis was "carcinoma" in 3, "ulcerating lesion" in 2, and "obstruction" in 1.

Comment. The gastric lesion for which the gastroenterostomy had been done apparently had failed to heal in the majority of these patients for 7 of the 11 patients required further surgical treatment within 4 years after their gastroenterostomy for gastric ulcer. This is particularly important in the case of the 6 patients who harbored a malignant process at the second operation. The true nature of the neoplasm evidently had not been recognized at the time of the gastroenterostomy in the 5 patients who, within 2 years following the first operation, had gastric resections for carcinoma. A biopsy for the purpose of establishing a microscopic diagnosis would have been of immense value at the time of the gastroenterostomy and probably would have altered the surgical attack at the earlier and more favorable period. The following case report illustrates the point, although this patient was more fortunate in the outcome than are many others.

A male, aged 62 years, had undergone exploration at the clinic 1 year previously for an ulcer high on the posterior wall of the stomach, just below the insertion of the esophagus. The ulcer was about 2.5 centimeters in diameter. A posterior gastroenterostomy was carried out because a direct attack seemed impossible on account of the inaccessible position of the lesion and the large number of adhesions already present from a previous laparotomy.

The patient returned to the clinic 1 year later because of symptoms referable to the stomach. These consisted of persistent bloating and epigastric distress. The free hydrochloric acid in the gastric contents measured 36 units and the total acids 52 units after the usual test meal. Roentgenographic examination again demonstrated the gastric ulcer, though it appeared to be smaller in size after the gastroenterostomy. Operation was advised and approximately four-fifths of the stomach was resected. A superficial colloid carcinoma on the posterior wall of the stomach just distal to the insertion of the esophagus was encountered. The lesion had not invaded the serosa nor the regional lymph nodes. The patient soon returned home and progressed well from the standpoint of the stomach for 5 years when he died from some cause which could not be determined in our follow-up.

TABLE III.—PATHOLOGY OF CARCINOMA OF STOMACH FOLLOWING GASTROENTEROSTOMY FOR DUODENAL ULCER

Gross description	Number	Size, cm.	Grade (Broders')	Type (Dukes')
Ulcer type	3	5 cm. in diameter*	4	B
		3x2x0.5*	3	B
		3x2x2*	2	A
Massive cancer	3	7x5x2	4	C
		7x6x4	2	C
		Large	4	C
Total	6		2-grade 2	1-A
			1-grade 3	2-B
			3-grade 4	3-C

*Thought to be a benign ulcer at operation.

Pathologic features. Of the 6 malignant lesions in this group, 3 were malignant ulcers but all were thought to be benign gastric ulcers until they were examined microscopically by the pathologist (Table III). One of these patients had also an associated smaller benign gastric ulcer, 0.5 centimeter in diameter, about 6 centimeters distal to the malignant ulcer on the lesser curvature. Three were grade 4 lesions (Broders' classification) and the serosa and regional lymph nodes had been invaded in 3 instances.

GASTRIC LESIONS THAT FOLLOWED GASTROENTEROSTOMY FOR OTHER REASONS

One patient was included in this study because she had a gastric cancer that followed gastroenterostomy that had been done 23 years previously for some indeterminate lesion.

A female, aged 65 years, had complained of daily intractable epigastric distress since gastroenterostomy had been made. The first impression of the clinicians on her admission to the clinic was that her complaints were functional in nature but with further study operation was advised because of her history of persistent symptoms and because the roentgenographic diagnosis of probable jejunal ulcer and jejunitis. An extensive, diffuse grade 4 small cell adenocarcinoma involving the lower half of the stomach and first portion of the duodenum was found. It had invaded the serosa and regional lymph nodes. The lesion was of the linitis plastica type and was associated with a marked inflammatory reaction in the gastric wall as well as around the gastroenteric stoma. A palliative partial gastrectomy was carried out. The patient, however, succumbed 4 weeks later from complications, probably peritonitis.

SUMMARY AND CONCLUSIONS

A review of data on 53 patients in whom lesions in the stomach developed after gastroenterostomy has confirmed the impression of the authors that such lesions will show a high incidence of malignancy. Eighteen (34 per cent) of the 53 patients in this series had malignant lesions of the stomach requiring subsequent gastric resection. Of the 53 gastroenteric stomas, 41 had been made on account of duodenal ulcer, 11 on account of gastric ulcer, and 1 for other reasons.

Eleven of the 41 patients who had gastroenterostomy for duodenal ulcer experienced malignant lesions of the stomach, as demonstrated subsequently at the time of operation. It has been found to be extremely difficult to determine clinically the true nature of a lesion in a stomach that has undergone gastroenterostomy. The clinical history and findings may mask the real nature of such a lesion and give the impression that a malignant neoplasm is benign. Five of the 11 patients in whom carcinoma of the stomach developed gave a history that was quite characteristic of peptic ulcer, and in 4 of these 11 patients appreciable quantities of free hydrochloric acid were found in the gastric contents.

Six of the 11 patients who had had a gastroenteric stoma made for gastric ulcer were found to have malignant lesions of the stomach which either had gone unrecognized at the time of gastroenterostomy or had developed later. At operation some of these malignant lesions appeared to be benign grossly. Gastroenterostomy alone without local excision or biopsy of the gastric ulcer was done in 8 persons, in 6 of whom malignant gastric lesions were found at the time of operation. A biopsy or local excision of the gastric ulcer at the time of the original operation would have been of immense value and might have changed the surgical attack to a more radical one.

The roentgenographic examination of a lesion in the stomach following gastroenterostomy has been found to be more than usually difficult owing to the marked structural

changes, inflammatory conditions and obstructive features that are so often encountered. An accurate roentgenographic diagnosis has been found to be almost impossible when the new lesion has developed in the portion of the stomach distal to the old gastroenteric stoma.

In view of the high incidence of malignancy in the ulcerating lesions of the stomach following gastroenterostomy, the importance of suspecting and ruling out carcinoma before any conservative management is instituted cannot be emphasized too strongly.

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ANALYSIS OF POSTOPERATIVE CHOLANGIOGRAMS

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THERE is a lack of precision in descriptions of the common bile duct. In an effort to clarify this subject we have analyzed delayed, or indirect, cholangiograms (6, 20, 21, 26). These studies have been supplemented by clinical and postmortem observations.

METHOD

The cholangiograms were made of patients 5 or more days postoperative by the injection of contrast substances into a tube indwelling in the biliary tract. Cholangiography was usually performed 3 hours after the midday meal. Fifteen minutes before examination the patient was given a sublingual dose of nitroglycerine (0.006 mgm.).

Twenty cubic centimeters of diodrast was warmed to body temperature in a syringe fitted with a No. 21 gauge needle. All air bubbles were eliminated. The hypodermic needle was inserted into the external limb of the tube as close to the abdominal wall as conveniently possible and a (curved) hemostat clamped across the needle and tubing to create a fluid tight junction.

Two to 5 cubic centimeters of diodrast were injected into the tubing under fluoroscopic observation. After 20 to 40 seconds, an additional 2 to 10 cubic centimeters were injected. During and after this observation period, localized roentgenoscopic films were made, so that at least 2 anteroposterior and 1 right lateral 10 by 12 film exposures were made, with the Bucky diaphragm and with 100 milliampere tube current. More diodrast was injected if necessary. In some cases, reexamination was done after 30 minutes while the external limb of the indwelling tube was clamped. After completion of radiographic studies, the tube was irrigated with normal saline solution.

Injection studies were performed upon fresh autopsy specimens after removal of the duodenum, hepatic pedicle, and the adjacent pancreas. The proximal and distal openings of the duodenum were ligated, or clamped. In some instances, air was injected into the duodenal canal in order to overcome serosal agglutination and to separate mucosal folds. The pancreatic and common bile ducts were identified and cannulated at an adequate distance from the duodenal wall. Ureteral catheters or metal needles were tied into place. Five to 15 cubic centimeters of diodrast or iodochlorol were injected into each duct and roentgenograms were made.

OBSERVATIONS

A total of 50 cholangiograms on 41 patients was reviewed. In this series of cholangiograms there was no mortality due to the examination. The procedure was complicated in only 2 cases, and in those by clinical symptoms of pancreatitis which appeared for 2 to 4 days following cholangiography. Three patients who died subsequently in the hospital were autopsied. One died because of a stone impacted in the common bile duct, 1 because of myocardial failure and hepatocellular disease, and 1 as a result of hemorrhage from the hepatic artery into the common bile duct (31).

The normal cholangiogram. Under fluoroscopic observation the contrast media injected through the T tube normally entered the common bile duct and duodenum without delay or obstruction. The origin of the common bile duct was estimated to be in the right half of the median sagittal plane of the body at approximately the twelfth thoracic intervertebral space. The capacity of the normal common duct varied from 5 to 10

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cubic centimeters. Fluoroscopically and roentgenographically (Fig. 1) in the anteroposterior plane, the contrast substance was seen to follow a continuously curving course. It first was curved slightly medially, then it passed laterally and nearly parallel to the midline. As the duct terminated there was a sharp change in direction with angulation toward the right lateral abdominal wall and a concomitant decrease in the diameter of the common duct.

On lateral view, a flat double curve was seen in the course of the common duct which was in the ventral vertical plane. At first the common duct curved anteriorly; then, inferiorly and posteriorly to the level of the duodenum. In this area it usually overlaid the vertical axis of the anterior border of the vertebral column. The common duct finally coursed slightly anteriorly and inferiorly to end within the duodenal canal.

In 50 cholangiograms the widest diameter of the common bile duct varied from 4 to 23 millimeters, averaging 11 millimeters. Excluding 25 instances in which definite abnormalities of the common bile duct existed, it was found that the diameter of the normal common bile duct varied from 4 to 10 millimeters, with an average of 7 millimeters.

A decrease in diameter of the terminal segment of the extraduodenal common bile duct, associated with a straightening of the duct wall was found in 16 patients. The narrowed segment measured from 4 to 18 millimeters in length (mean and average was 10 millimeters). This narrowed portion probably represented the transpancreatic portion of the extraduodenal common bile duct.

The transduodenal segment of the common duct was visualized on 42 cholangiograms. Of these, 21 were considered to be normal in appearance. The duct terminated at approximately the level of the second lumbar transverse process in the majority of cases, and varied from levels of the first to the third transverse processes. The average length of the transduodenal segment ("papilla") of the common bile duct was found to be 14 millimeters (32).

The lumen of the common bile duct decreased in diameter as it crossed the duodenal wall. Its sides presented a double concavity, or scalloping, which gave the lumen of the duct the appearance of a funnel. The duct finally terminated as a thin filamentous canal. The terminal orifice of the common bile duct measured 1 millimeter or less in diameter in 16 cases, between 1 and 2 millimeters in 25 cases, and was 4 millimeters in diameter in 1 case. Normally the duodenal canal filled rapidly above and below the terminal orifice of the common bile duct.

Fig. 1. *Normal cholangiogram* made after injection of diodrast into the T tube. Diodrast entered the duodenum without delay. There is a medial convexity to the extraduodenal common bile duct. The distal segment of the common duct is seen to taper slowly in diameter to empty into the medial aspect of the descending portion of the duodenum, at approximately the level of the transverse process of the third lumbar vertebra.

The transduodenal (pars intestinalis) segment of the common bile duct was seen most clearly on injected fresh postmortem specimens (Fig. 2a). The lumen appeared as a curving funnel which gradually decreased to a filamentous channel. The axis of the transduodenal segment entered the duodenal wall at slightly less than a right angle and usually traversed the greater portion of the duodenal wall parallel to the axis of the duodenal canal. As it terminated, the common bile duct

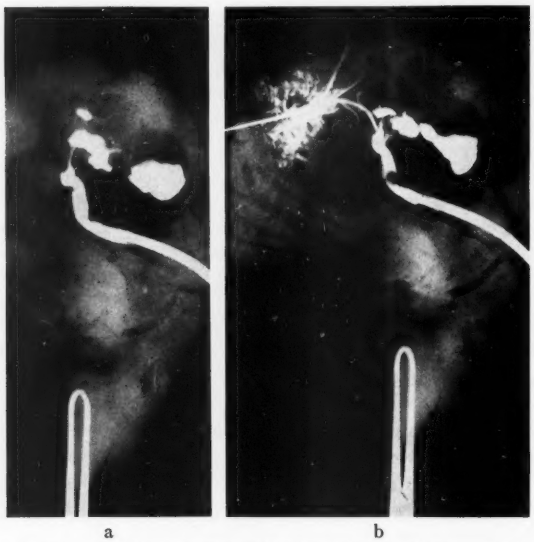

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Fig. 2. a, *Choledochogram* made after injection of common bile duct with diodrast through catheter. The terminal portion of the common duct is seen as a tapering continuously curving funnel, ending as a filamentous channel. b, *Pancreatic ductogram* made after injection of common bile duct with diodrast and of pancreatic duct with lipiodol. The common duct is visualized as in a. The lipiodol has diffused through the pancreatic ductal system. Some of the oil has emptied into the duodenum through a small separate orifice, adjacent to the termination of the common bile duct.

turned to empty into the duodenal lumen at approximately a right angle to the duodenal axis.

On the pancreatic ductogram (Fig. 2b), the pancreatic duct was seen as a gently curving arc which approached the termination of the common bile duct to empty into the duodenal canal after an acute bend in its axis toward the orifice of the common bile duct. Separate orifices for pancreatic and common bile ducts were usually visualized.

The abnormal cholangiogram. Abnormalities were observed in 25 of the 50 cholangiograms. These were: choledocholithiasis, 12 cases; spasm, 6 cases; reflux into pancreatic duct, 4 cases; stricture of common bile duct, 3 cases.

Fluoroscopic observation revealed 17 instances in which there was delay in the entrance of the dye into the duodenum. This was due to: (a) residual calculi within the common duct and an irregular transduodenal segment in 13 cases; (b) to spasm associated with dyskinesia in 3 cases; and (c) to an artificial choledochoduodenostomy in 1 case.

Choledocholithiasis. When injected through the external limb of the T tube in patients with choledocholithiasis, diodrast entered the duodenum sluggishly. The capacity of the duct was 15 to 25 cubic centimeters. The common bile, common hepatic, and frequently the hepatic ducts were dilated. Calculi appeared as radiolucent defects. They were usually circular, crescentic or irregular in contour. Stones were most frequently impacted at the termination of the extraduodenal course of the common bile duct (Fig. 3). Diodrast, which passed beyond a calculus, filled the tapering filamentous lumen of the termination of the "pars intestinalis" of the common bile duct.

In 1 instance reflux was seen from the common bile duct to the pancreatic duct simultaneously with the impaction of a stone

in the common bile duct (Fig. 3). In this case, the site of the stone impaction was 1 centimeter proximal to the location of the reflux.

It was important to distinguish artefacts, such as air bubbles, from calculi. The former were typically inconstant in location and were not facetted. Congenital folds in the mucous membrane of the duct wall were also confusing.

Spasm. In patients with active spasm of the sphincter of Oddi, diodrast was injected into the external limb of the T tube against resistance. It entered the duodenum as a slow trickle. However, free flow into the duodenum commonly occurred at some time during the cholangiography. The injection was usually painful, although pain was relieved when the duct emptied. The capacity of the common bile duct was 15 to 20 cubic centimeters in these patients with spasm. On the roentgenogram there was increased angulation between the extraduodenal and transduodenal segments of the common bile duct. At its termination the lumen of the common bile duct tapered rapidly to a narrow filament, usually more irregular and longer than normal.

Reflux into pancreatic duct. In most patients who were found to have reflux from the common duct into the pancreatic duct, diodrast injected in the external limb of the T tube entered the duodenum almost immediately. During the interval between additional injections of diodrast it was observed that the terminal portion of the pancreatic duct was filled with contrast media from the common bile duct (Fig. 4a). In other cases, the pancreatic duct was partially filled before the contrast medium was seen in the duodenum (Fig. 4b). The length of the common channel for pancreatic and common bile ducts varied from 2 to 10 millimeters. At its termination, the lumen of the common channel measured from 1 to 2 millimeters in diameter.

Clinical pancreatitis was present (31) in 1 of the 4 patients with reflux (Fig. 4a). Signs and symptoms of transient pancreatitis appeared after cholangiography in 1 patient who had reflux, and in 1 patient without reflux. Another patient who presented reflux on one examination did not present it on subsequent studies.

Fig. 3. *Choledocholithiasis and reflux.* Cholangiogram made after injection of diodrast into the T tube. The contrast medium entered the duodenum very sluggishly and was injected against marked resistance. The biliary ducts are dilated. The pars intestinalis of the common bile duct is seen as an S shaped filamentous termination in the medial aspect of the descending duodenum. The terminal portion of the pancreatic duct is visualized adjacent to the pars intestinalis through reflux from the common bile duct. A circular shadow of a calculus is impacted in the distal portion of the extraduodenal common bile duct, proximal to the site for reflux into the pancreatic duct. This stone disappeared after Pribram therapy.

Stricture. In the presence of a complete stricture of the common duct, diodrast injected through the external limb of the T tube entered the common bile duct against marked resistance. Diodrast did not enter the duodenum; the hepatic radicles were markedly dilated and reflux of contrast medium occurred along the T tube.

In these cases with stricture the content of the biliary tree was 25 to 35 cubic centimeters. The diameter of the lumen of the common bile duct was greater than 18 millimeters. The distal portion of the common bile duct was distorted and blunted with con-

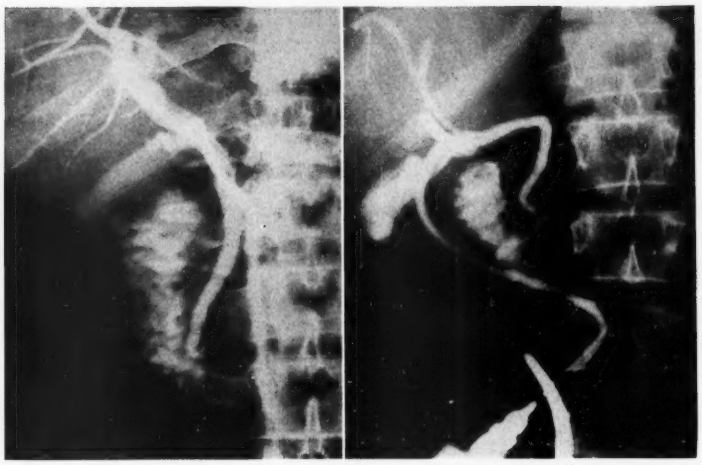

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Fig. 4. a, *Reflux* (*CM*). Roentgenogram made after injection of diodrast into the T tube. The diodrast entered the duodenum without obstruction. The proximal segment of the common duct is displaced laterally because of extrinsic pressure from a pseudocyst of the pancreas. The distal segment of the common bile duct ends as an S shaped curve terminating in the medial portion of the descending duodenum at the level of the third lumbar transverse process. There is slight diminution in the caliber of the common bile duct: the terminal portion of the pancreatic duct appears of equal or greater diameter than the bile duct in the area of the pars intestinalis. The distal centimeter of the pancreatic duct is visualized, as well as 7 to 8 millimeters of the common channel present in this case for the common bile and pancreatic ducts. Duodenal canal filled prior to demonstration of reflux. b, *Reflux* (*LC*). Roentgenograph taken after injection of diodrast into the T tube. The course and diameter of the common duct are normal. The termination (pars intestinalis) of the common duct cannot be clearly identified. At the papilla the termination of the pancreatic duct and approximately 1 centimeter of its distal course is visualized. Pancreatic duct reflux occurred just prior to appearance of contrast medium in the duodenal canal. Diodrast entered the duodenum rapidly. A cholangiogram repeated 10 days later revealed no evidence of reflux. The patient has been asymptomatic for 2 years.

vexity directed caudad. Diodrast was not visualized in the transpancreatic or transduodenal portions of the common bile duct.

DISCUSSION

Routine cholangiography in patients following common duct operations has increased knowledge of the physiology and anatomy of the common bile duct and their surgical significance (5, 6, 7, 10, 11, 13, 15, 22).

However, a lack of uniform terminology exists as well as an inadequate description of the normal and abnormal common bile duct (8, 10, 14, 27, 28). The major deficiencies are: (a) insufficient description of the fluoroscopic findings; (b) lack of existing standards for measurement of the common duct diameter; (c) insufficient description of the details and character of the termination of the duct; and (d) incomplete definition as to the location of the duct and its divisions.

In addition, reference is made in the literature to the "ampulla" and the "papilla" of Vater as if they were interchangeable terms. However, the "ampulla," as a "dilatation" exists only in the early embryo as a result of the merging of the hepatopancreatic duct with the duodenal canal and rapidly recedes to nonexistence (3, 8, 12, 29). The "papilla," or "swelling" is a definite portion of the termination of the common duct in the adult (12). It represents an increase in tissues comprising a sphincter-like mechanism identified by Oddi (23). It, most likely, originates in the mesenchymal structures peculiar to the common duct tissues (8, 29).

The common bile duct may be divided into extraduodenal and transduodenal segments. The transduodenal segment is equivalent to the "papilla" or the "pars intestinalis" (8, 12). The extraduodenal segment, in certain instances, may present a transpancreatic portion (7, 27). These divisions of the common bile duct can be identified, on roentgenography, by the injection of a contrast medium into the common duct.

The common bile duct presents a constantly curving axis in both anteroposterior and lateral planes. Straightening of its course may indicate an abnormality due to extrinsic pressure (Fig. 4a). In the distal portion of the extraduodenal common bile duct, however, straightening of the duct may indicate that its course is transpancreatic. The course and direction of the common bile duct depends upon the anatomical disposition of adjacent viscera, but can usually be predicted in the normal individual.

Roentgenographically, the common bile duct presents its widest diameter distal to the junction of the cystic and hepatic ducts and proximal to the transpancreatic segment. The average diameter of the widest part of the normal common bile duct on the cholangiogram is 6.9 millimeters. Measurement of the same segment of the choledochus in fixed and fresh anatomical specimens indicates an average diameter of 6.3 millimeters in the normal adult (32). In these studies, the duct is abnormal when its diameter is greater than 1 centimeter.

The transduodenal segment of the common bile duct may be identified by its change in direction, and its funnel shape, as its lumen decreases in size to terminate in a filamentous canal. Frequently, this segment of the duct cannot be visualized on roentgenography. Its patency must then be inferred by the presence of sufficient contrast medium in the duodenum. Fluoroscopic observation may reveal a correlation between symptoms of biliary dyskinesia and the existence of spasm in the transduodenal segment of the common bile duct.

In this series there are 4 instances (8 per cent) of reflux from the common bile duct into the pancreatic duct. In only 2 of these are the findings persistent, since subsequent examinations in the others did not demonstrate diodrast in the pancreatic duct. This observation contributes support to Archibald's theory (1, 2) that sphincteric muscle action at the papilla is segmental and intermittent in character and that reflux into the pancreatic duct can occur when the most distal segment of the sphincter is active. The relationship between reflux and pancreatitis (11, 13, 19, 24, 25) cannot be demonstrated in this series, since pancreatitis occurs both with and without evidence of reflux and since reflux occurs both before and after diodrast enters the duodenum from the common duct. It has been observed that papillary sphincterotomy may be indicated for relief of symptoms caused by reflux occurring into the pancreatic duct before the common duct empties into the duodenum (13).

It is of extreme interest to note that calculi are impacted at the distal portion of the extraduodenal segment of the common bile duct. It is obvious that the narrow lumen and the thickened wall of the transduodenal segment of the common duct normally act as a barrier to the passage of a calculus from the common duct into the duodenum.

In certain cases a distorted, feathery contour of the papilla and distal duct segment is accompanied by delayed entry of diodrast into the duodenum. These changes in the "pars intestinalis" are frequently transient. In many cases, they are secondary to alteration in physiologic mechanisms, necessarily occurring after a cholecystectomy; in others, a manifestation of papillary muscular spasm. In some, they are an indication of associated regional edema. This group includes patients with pre-existing choledocholithiasis. Trauma attending exploration of the common bile duct with the Bakes' dilators may be a factor in producing these findings. Because of the thin tortuous character of the termination of the normal common bile duct it is likely that papillary tissues would be injured by a forcible dilatation. In 1 case, a stricture of the termination of the duct appeared 6 months after original common duct exploration. This, as well as more transient cases, could have been secondary to tissue reaction

occurring in the papillary tissues as emphasized by Branch, Bailey and Zollinger, and Zawisch.

It is recommended that only a small ureteral catheter 3 to 5 millimeters in maximum diameter be used as a probe. This type of instrument is thin, sturdy, and flexible. In addition, fluid can be injected through the ureteral catheter to demonstrate the actual patency of the choledochal canal.

SUMMARY

1. Fifty postoperative indirect cholangiograms on 41 patients have been reviewed. Roentgenographic and fluoroscopic descriptions correlated with clinical findings of the normal and abnormal common bile duct have been given. In this series abnormalities in the cholangiogram included (a) choledocholithiasis, (b) spasm at the termination of the duct, (c) stricture of the common bile duct, and (d) reflux into the pancreatic duct from the common bile duct.

2. The importance of careful fluoroscopic observation during cholangiography was stressed.

3. The course of the normal common bile duct has been described as a constantly curving tube which was composed of extraduodenal and transduodenal segments. The most distal portion of the extraduodenal segment was identified as "transpancreatic," when its contour was straightened and its diameter decreased.

4. The average diameter of the extraduodenal common bile duct on the cholangiogram has been found to be 6.9 millimeters. The average diameter of the orifice of the common bile duct within the duodenum was 1.5 millimeters.

5. The transduodenal segment of the common bile duct had a funnel shape and a decreasing diameter, the lumen of which terminated as a filamentous canal. There was no evidence that an "ampulla" was present. It was suggested that the termination of the common bile duct be designated only as the "papilla."

6. For routine operative demonstration of patency at the termination of the common bile duct, it was recommended that a soft, thin, flexible and hollow instrument, such as the ureteral catheter be used.

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CHANGES IN RENAL FUNCTION FOLLOWING URETERAL TRANSPLANTATION

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As a result of the advancements made in modern surgery, ureteral transplantation has become a procedure which is more widely employed not only by the urologist but also by the general surgeon and gynecologist. For this reason it is more important than ever to be familiar with those factors which influence success or failure in this type of operation.

In the past, emphasis has been placed predominantly on the surgical aspects of the problem and a variety of technical modifications have been devised in order to reduce the occurrence of complications characteristic of this procedure. In addition, well planned preoperative and postoperative management has been recognized to have contributed materially to the improvement of the postoperative results.

While it cannot be denied that the above mentioned factors are of major importance, it has become increasingly evident that other phenomena such as kidney function, as well as morphology and dynamics of the upper urinary tract, have an equally great influence on the outcome of each individual case. It appears from a study of the literature that the importance of these factors has not been sufficiently appreciated in the past, and it is the purpose of this report to present results of investigations which were carried out at the Roswell Park Memorial Institute in an attempt to examine the effect of ureteral transplantation on renal function. The data obtained on 20 patients who underwent various methods of ureteral transplantation are believed to be of sufficient interest to warrant their publication at this time.

In conducting these investigations the authors adopted the following procedures: Blood chemistry studies, and, wherever feasible, phenolsulfonphthalein tests as well as quantitative determinations of the urea nitrogen output in the urine were carried out daily before and after operation. The data obtained were correlated with the findings of excretory urograms which were made subsequently at regular intervals. Accurate calculation of phenolsulfonphthalein excretion and urine urea elimination encountered no difficulties in patients with cutaneous ureterostomy where the collection of uncontaminated specimens was possible for an indefinite period of time. However, following ureterointestinal anastomoses admixture of blood did not permit, in some cases, accurate phenolsulfonphthalein determination during the first 24 to 48 hours following operation, and, as a rule, measurement of the urine urea output had to be discontinued after the 5th to 7th postoperative day because contamination of the specimen with large amounts of feces made further tests impractical.[1]

In the consideration of the effect of ureteral transplantation on kidney function a distinction was made between patients with no demonstrable gross disturbance of the upper urinary tract physiology and patients where evidence of obstruction suggested pre-existing kidney damage. This was done for the following reason: Postoperative impairment of renal function was the rule in the 1st group of cases, whereas improvement took place in some cases of the 2nd group. The results obtained in both categories indicate in general that the extent of changes of kidney function depended primarily on the type of transplant that was employed.

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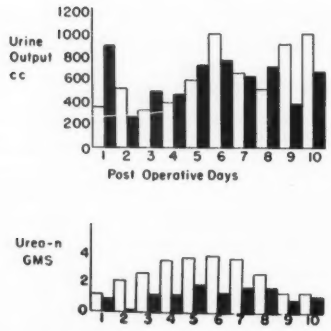
[1]For the purpose of separating urea nitrogen from the nitrogenous waste products of the stool the following procedure was adopted: The 24 hour specimen was filtered and an aliquot portion of it was used at first to determine the total amount of ammonia nitrogen after digestion with urease. Thereafter, the ammonia nitrogen of the specimen was calculated. The difference between the ammonia nitrogen after digestion with urease and ammonia nitrogen of the specimen represents the urea nitrogen.

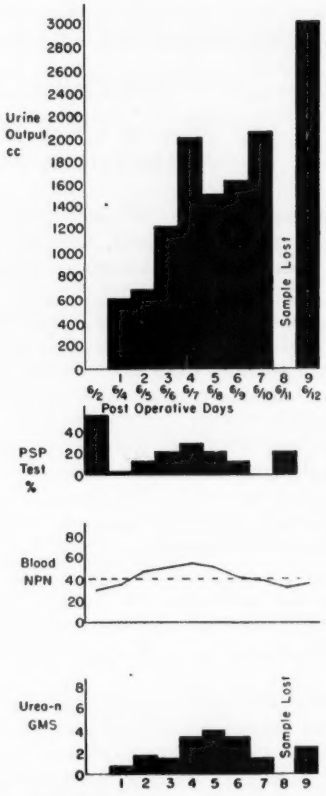


Graph 1. No significant changes of renal function following bilateral cutaneous ureterostomy. Light columns, left kidney, black columns, right kidney.

EFFECT OF URETERAL TRANSPLANTATION ON RENAL FUNCTIONS IN PATIENTS WITH APPARENTLY NORMAL UPPER URINARY TRACT PHYSIOLOGY

Cutaneous ureterostomy. No significant immediate kidney function impairment was observed following cutaneous ureterostomy. The amount of urine eliminated from each kidney remained approximately equal in patients with well functioning ureterostomy stomas and the excretion of phenolsulfonphthalein and of urine urea nitrogen maintained their original levels during the first postoperative period (Graph 1). However, during the later stages, when secondary infection with resultant chronic pyelonephritis leads to gradual diminution of functioning renal parenchyma, evidence of progressive kidney failure becomes demonstrable.

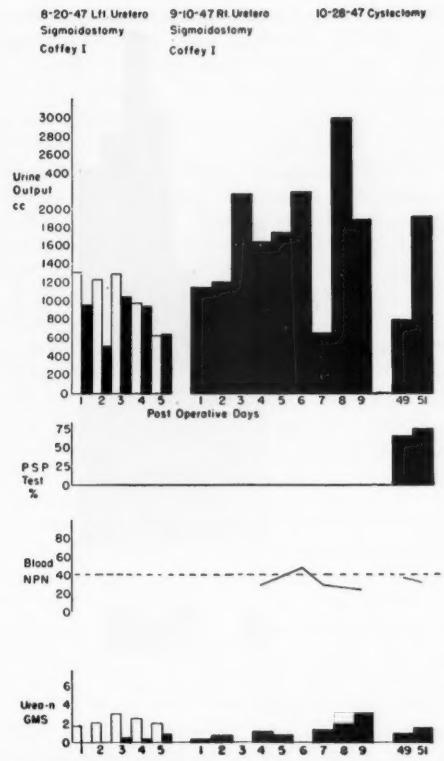
Ureterosigmoidostomy (Coffey I). In studying the effect of bilateral Coffey I ureterointestinal anastomosis on kidney function it became evident that this procedure produces a much more severe impact on renal physiology than had been anticipated heretofore. It was found that the urine secreted during the first few days after operation contained inadequate amounts of nitrogenous waste products and correspondingly, phenolsulfonphthalein elimination was poor. This marked degree of functional derangement was observed consistently even in patients where apparently sufficient amounts of urine were eliminated promptly and where subsequent urograms suggested

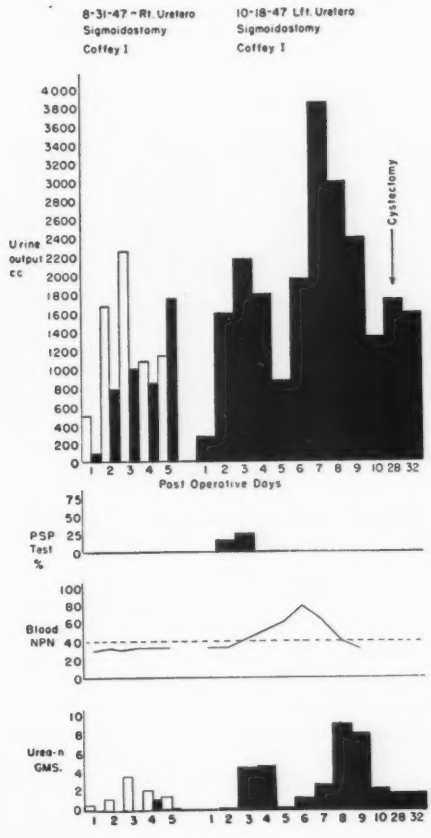


Graph 2. Demonstrates severe impairment of renal function following bilateral Coffey I operation.

well functioning anastomoses. As a result of this functional deficiency elevation of the blood nonprotein nitrogen is prone to occur and further rise is apt to continue until kidney function improves. However, severe uremia does not develop as a rule since partial recovery of renal function takes place between the 4th and 6th postoperative days thus restoring nitrogen balance.

Graph 2 serves as an illustration. This patient who had undergone a bilateral Coffey I ureterosigmoidostomy eliminated 600, 660, 1,200 and 2,000 cubic centimeters of urine during the first 4 postoperative days. Nevertheless, there was a steady increase of the blood nonprotein nitrogen to 55 milligrams per cent, which is explained by the fact that the urine

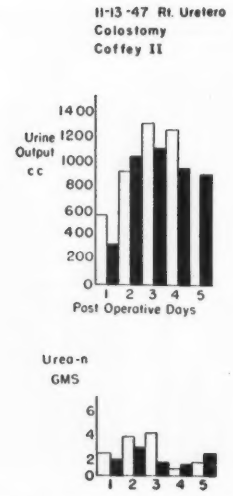




Graph 3, left, and 4. Showing discrepancy of urinary output and urine urea nitrogen excretion after Coffey I operation. Shaded columns represent samples collected from rectum.

secreted during the first 3 days following operation contained inadequate amounts of urea (0.5, 1.3, and 1.2 grams). An accordingly poor return of phenolsulfonphthalein (0, 10, and 14 per cent) was determined during this critical period. Following the 4th postoperative day kidney function showed marked improvement. The urine urea output increased to 3 and 4 grams daily and the blood nonprotein nitrogen returned to normal values by the 7th day following operation.

The results of investigations in a group of patients who underwent a 2 stage Coffey I operation conformed in principle with the aforementioned observations. Examination of urine samples collected separately from rectum and bladder revealed invariably severe suppression of renal function on the implanted side and no demonstrable functional changes on the nonimplanted side. Although the anastomoses functioned promptly and although the urine eliminated was adequate (Graph 3), in some instances even exceeding (Graph 4) the amount excreted by the nonimplanted side, it was regularly determined that the output of urea and phenolsulfonphthalein from the anastomosed kidney remained negligible during the first 3 to 4 postoperative days. As a rule partial restoration of kidney function took place 4 to 5 days after the operation. However, the functional efficiency did not attain its original preoperative level. Significant elevation of the blood nonprotein nitrogen was not observed following a

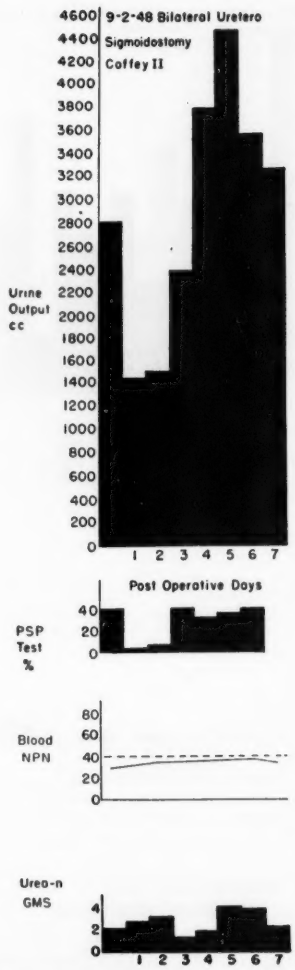


Graph 5. Demonstrates satisfactory output of urine and urine urea nitrogen following Coffey II operation.

first stage Coffey I procedure obviously because nitrogen balance was maintained during the critical days by nonimplanted side.

Ureterosigmoidostomy (Coffey II). During the further course of these investigations the question presented itself as to whether or not such a severe degree of kidney function impairment might be avoided by the employment of the Coffey II operation, where catheters assure free drainage of urine from the implanted side during the first postoperative days. To this end analogous studies were carried out in a group of patients in whom modified 1 stage bilateral or 2 stage Coffey II operations were performed. In carrying out these procedures a No. 8 or 10 F. whistle tip catheter was inserted for a distance of 10 centimeters into the ureteral stump before the distal end was buried into the sigmoid colon. In all cases the catheter was expelled spontaneously between the 5th and 7th postoperative day after admixture of stool had necessitated removal of the rectal drainage tube.

The results of these investigations indicate that suppression of kidney function was much less severe following a Coffey II procedure than in the group of cases where the Coffey I technique had been employed. It is evident from Graphs 5 and 6 that urine was eliminated



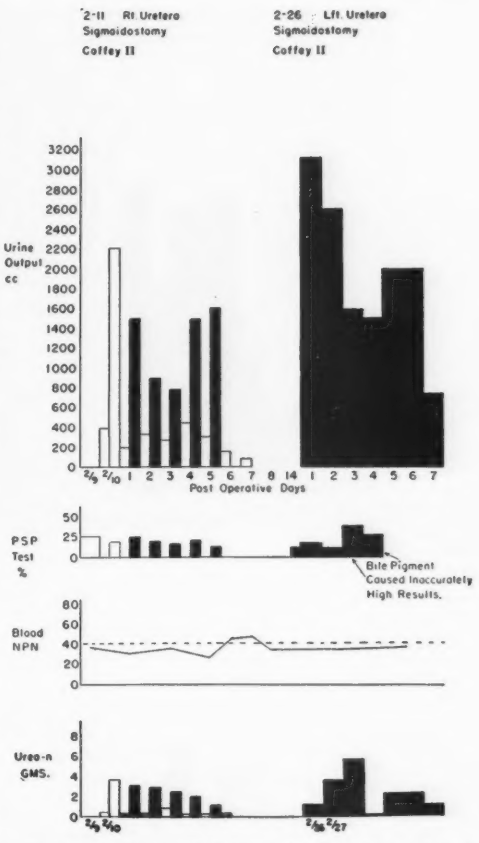
Graph 6. Adequate elimination of urine urea nitrogen and phenolsulfonphthalein following bilateral Coffey II operation.

following this type of operation not only in sufficient quantities but that it contained apparently adequate amounts of urea during the early postoperative period. In one of our patients with a poorly functioning left kidney where a first stage right Coffey II transplant had been carried out, it was even observed that the output of urea from the implanted side was sufficient enough to maintain the patient's urea nitrogen balance. Accordingly

it was determined that phenolsulfonphthalein excretion showed only moderate impairment compared to preoperative values and there was no elevation of the blood nonprotein nitrogen during the first 5 postoperative days. The transient slight elevation of the nonprotein nitrogen to 44 and 46 milligrams per cent during the following 2 days might be explained by the assumption that unimpeded drainage from kidney was interfered with temporarily after the catheter had been expelled (Graph 7).

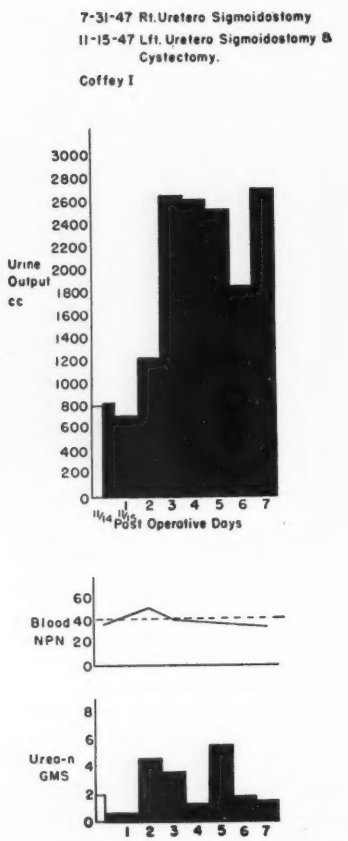
A comparison of the aforementioned data shows that the Coffey I operation produces a much more severe impact on kidney function during the early postoperative period than does the Coffey II procedure. Nevertheless, study of renal function during the later postoperative stages disclosed that, after the initial critical period had been overcome, neither of these methods was superior with regard to the ultimate functional results. This is enhanced by the fact that excretory urograms, which were made at 1 to 2 month intervals beginning on the 12th day after ureterosigmoidostomy, showed equivalent structural changes of the upper urinary tract regardless of whether the Coffey I or II technique had been employed (Fig. 1). Furthermore, in both groups kidney function tests 2 to 3 weeks following the 1st stage operation showed similar degrees of functional suppression and study of the urograms suggested an equally marked quantitative difference in the excretion of dye in favor of the nonimplanted side.

Investigations of the more remote effects of ureterosigmoidostomy on kidney function by means of measuring the output of phenolsulfonphthalein and urine urea nitrogen were handicapped by the obvious difficulty in obtaining uncontaminated samples of urine for examination. However, in patients with unilateral intestinal implants who had been subjected to the routine preoperative preparation for the 2nd stage operation, it was usually possible to collect suitable samples for functional tests through a rectal tube which was inserted for 24 hours preceding surgery. In general, the interval between both stages varied from 17 to 21 days, but in 2 patients who developed postoperative complications after the first operation transplantation of the

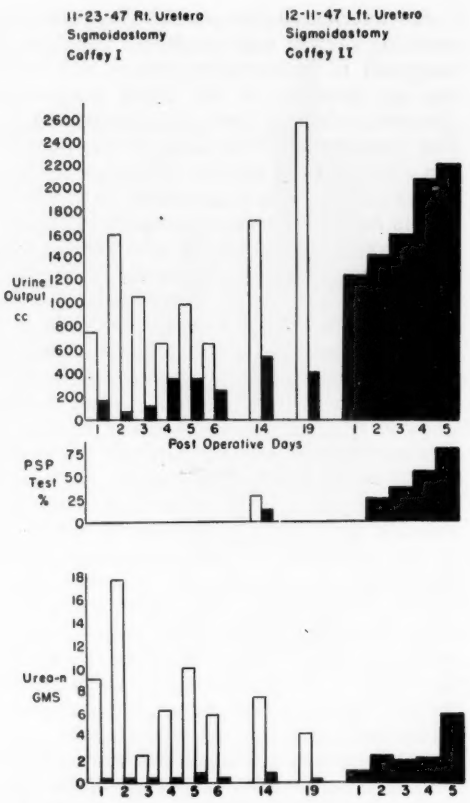


Graph 7. Nitrogen balance maintained by implanted side while other kidney ceases to function. Partial recovery of nonfunctioning kidney occurred following 2nd stage procedure (Fig. 2).

opposite side was postponed for 3 and 4 months respectively. The results of these tests revealed interesting data. It was found that a marked degree of functional impairment on the implanted side continued to persist and that the extent of this impairment was usually much more severe than could be anticipated from the urographic findings. This statement is illustrated by graphs 8 and 9 from which it can be seen that the amount of urea and phenolsulfonphthalein excreted from the implanted side remained markedly reduced not only one but equally so 4 months following the 1st stage operation



Graph 8. Demonstrates marked impairment of renal function of the implanted side 3½ months following first stage Coffey I operation.



Graph 9. Shows persistent depression of renal function of implanted side after Coffey I ureterosigmoidostomy. Adequate phenolsulfonphthalein and urea nitrogen elimination was maintained following 2nd stage Coffey II operation.

despite the fact that diodrast was eliminated satisfactorily.

In view of these findings the question presented itself as to how much reliance could be placed under these circumstances on the ability of a kidney to maintain nitrogen balance during a period of severe functional derangement of its mate which must be expected to occur if a 2nd stage Coffey I operation is planned. The results obtained during the course of these investigations indicate that the reserve power of the kidney on the implanted side is apparently greater than the functional tests performed before the 2nd operation would lead one to believe. No significant elevation of the blood nonprotein nitrogen developed even in patients where a 2nd stage Coffey I procedure had been employed and the elimination of urine urea nitrogen as well as phenolsulfonphthalein excretion exceeded expectations. For instance, it is evident from graph 8 that during the 24 hour period preceding the 2nd stage Coffey I ureterosigmoidostomy the output of urine was practically equal from the rectum (830 c.c.) and from the bladder (800 c.c.). Nevertheless, the rectal sample contained only 0.6 grams of urea nitrogen compared to 1.9 grams eliminated in the bladder specimen. Following surgery the total amount of urine urea nitrogen remained satis-

Fig. 1, left. Excretory urogram showing no significant difference in the outline of kidney pelves and ureters between right side (Coffey I) and left side (Coffey II).
Fig. 2. Partial recovery of nonfunctioning left kidney following Coffey II ureterosigmoidostomy.

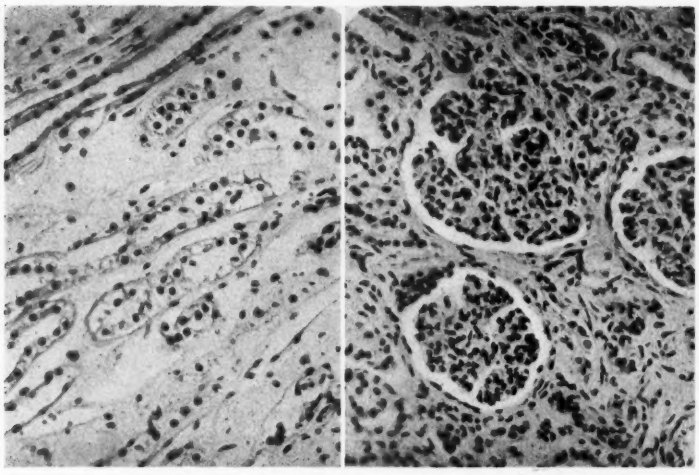
factory and more or less in proportion to the quantity of urine produced. A transient elevation of the blood nonprotein nitrogen to 49 milligrams per cent which developed on the 2nd postoperative day did not cause clinical symptoms. Graph 9, where a 2nd stage Coffey II procedure was employed, demonstrates even more convincingly that marked functional impairment of the previously implanted side should not deter the surgeon from carrying out a 2nd stage operation in patients who are otherwise considered suitable for surgery.

EFFECT OF URETERAL TRANSPLANTATION ON RENAL FUNCTION IN PATIENTS WITH PREOPERATIVE RENAL DAMAGE DUE TO URETERAL OBSTRUCTION

It is obvious that the problem presented in this group of patients is entirely different. In the past cutaneous ureterostomy was considered to be the only suitable method to deviate the urinary stream in patients with renal damage due to markedly dilated ureters inasmuch as this procedure which entailed comparatively little risk was known to induce partial recovery of renal function. On the other hand, ureterointestinal implantation was thought to be contraindicated in these cases because it was feared that such an operation would add insult to injury. However, recent workers (Ferris, Priestley, Marshall) have convincingly demonstrated that even a high degree of obstruction with markedly reduced kidney function need not necessarily be considered a deterrent for ureterosigmoidostomy. Our investigations agree. For instance, in one of our cases where the left kidney was damaged to such an extent that gradual cessation of urinary output developed between the 1st and 2nd stage operations (Graph 7), partial recovery of kidney function took place following implantation of the obstructed ureter into the sigmoid as can be seen from the excretory urogram made on the 12th day after the 2nd stage operation (Fig. 2).

EFFECT OF EXTENSIVE NONUROLOGICAL SURGERY ON RENAL FUNCTION IN CONTROLS

No evidence of changes of kidney function was determined during postoperative course in 5 control patients who underwent major surgical procedures for gastrointestinal disease.



a b

Fig. 3. a, Severe degenerative changes of the collecting tubules. b, Minimal degenerative changes in the renal cortex.

Comment. The aforementioned investigations represent an attempt to evaluate the importance of those factors which influence renal function following various methods of ureteral transplantation. These studies were prompted by the occurrence of uremia which developed in some of our patients following bilateral Coffey I ureterosigmoidostomy although the daily output of urine exceeded 1,000 cubic centimeters. Recent experiences at the Mayo Clinic conform with these observations. Priestley, by referring to investigations of Ferris, emphasized that a transient rise of the blood nonprotein nitrogen occurs commonly following this procedure and the alteration of the blood chemistry, which develops shortly after operation, is believed to be due to reabsorption of nitrogenous waste products from the large bowel. In support of this theory Priestley and Ferris infer that this complication may be overcome by the use of frequent irrigation of the rectosigmoid.

It was certain from the beginning that investigation of this subject, which heretofore had not been explored, presented a fascinating challenge. As was anticipated, these studies did not add materially to the present knowledge of changes in kidney function following cutaneous ureterostomy. However, during the course of our investigations it became apparent that ureterosigmoidostomy created various degrees of derangement of renal function, the severity of which had not been sufficiently appreciated as a whole.

It must be surmised that many factors determine the extent of kidney function impairment following ureterointestinal transplantation, but the most important ones are: (1) postoperative edema at the site of anastomosis, (2) injury to the blood supply of the ureteral stump, and (3) interference with the normal dynamics of the upper urinary tract. Of these, edema at the site of implantation plays the most decisive role inasmuch as it represents a complication which, although it may be reduced by perfection of the surgical technique, cannot be avoided completely. Once it becomes manifest it causes not only varying degrees of urinary obstruction but also compression of those blood vessels which maintain the blood supply of the ureteral stump within the trough. While it is realized that adequate vascularization of the implanted ureter is of vital importance for the successful outcome of ureterosigmoidostomy, it is not believed that this factor has a significant influence on renal function during the early postoperative period with which these investigations were pr-

marily concerned. Injury to the blood supply of the ureter is more apt to have an adverse effect on kidney function during the later stages when insufficient circulation may be one of the contributory phenomena to stricture formation at the site of anastomosis.

Evidence collected during the course of our investigations rather suggests that postoperative edema with resulting back pressure is primarily responsible if severe functional derangement of renal physiology develops during the initial postoperative period following an otherwise successful ureterosigmoidostomy. This statement is supported by the observation that serious kidney function impairment could usually be avoided by employing a modified Coffey II technique where catheter drainage offset the obstructing effect of edema during the first postoperative days. On the other hand, the inadequate elimination of urine urea nitrogen, which in general was observed to occur during the early stages after a Coffey I operation, indicates clearly that this procedure deprives the kidney, at least temporarily, of its ability to maintain nitrogen balance. Yet, even following a bilateral Coffey I procedure, clinical manifestations of renal insufficiency need not develop necessarily as long as adequate restoration of kidney function takes place before the blood nonprotein nitrogen shows marked elevation. As a rule, partial recovery of renal function occurs after the 4th to 6th postoperative day, but, should functional imbalance persist beyond this period uremia is bound to develop and uremic death may ensue even though the patient continues to eliminate urine in satisfactory amounts. This was experienced in 3 patients who underwent a bilateral Coffey I ureterosigmoidostomy. These 3 patients were not included in this case series because they were operated upon before these investigations were undertaken. Postmortem examination in each of these 3 cases disclosed not only patent anastomoses but also absence of marked dilatation of ureters and kidney pelves. On cut section the kidneys showed signs of pyelonephritis. Nevertheless, the macroscopic changes were not severe enough to account for uremic death. Histological study, however, disclosed characteristic findings which seem to be peculiar to this type of renal failure. The collecting tubules which were moderately dilated showed evidence of degeneration varying in degree from cloudy swelling to complete necrosis. In some areas partially necrotic tubules were filled with casts of debris. Widespread hemorrhage and round cell infiltration into the intertubular spaces were common throughout. In striking contrast to the severity of the changes encountered in the medullary portion of the kidney was the minimal amount of involvement of the renal cortex where the glomeruli were either intact or fibrosed due to pre-existing arteriosclerotic disease. Degenerative changes of the proximal convoluted tubulus were either absent or not severe (Fig. 3a and b). Altogether, the histological picture presented was quite similar to that which has been observed by Hinman during his experimental work on hydronephrosis where he states that "the tubular unit undergoes progressive dilatation, collapse and atrophy, with the glomerulus resisting longest."

In the light of Hinman's investigations on hydronephrosis these pathological changes must be considered important inasmuch as they suggest a plausible explanation for the mechanism of transient renal failure which is apt to develop following a Coffey I ureterosigmoidostomy. Compression of the ureteral lumen by postoperative edema at the site of implantation is bound to injure the functional efficiency of the kidney which is forced to secrete against rapidly developing back pressure. While increased peristaltic action of kidney pelvis and ureter may be strong enough to overcome partial ureteral obstruction at the site of anastomosis it is evident that the sudden rise of the intrapelvic pressure has a depressing effect on the function of the lower renal segments. In consideration of these factors, which are undoubtedly in part responsible for the aforementioned characteristic pathological changes, the inadequate elimination of waste products in the urine of these patients is not surprising. As long as these conditions exist it may be presumed that function of lower nephron remains depressed to such an extent that the urine eliminated represents nothing but a glomerular filtrate.

If these changes persist permanent kidney insufficiency is bound to occur and uremic death will ensue if both kidneys are involved. In most instances, however, partial recovery takes place before renal damage becomes irreversible. In this case restoration of functional balance may be due either to subsidence of the obstructive edema or readjustment of the kidney to the altered hydrodynamics.

The degree of recovery of renal function depends on several factors such as adequacy of the anastomosis, original functional efficiency of the kidney and the patient's general condition following surgery. In addition, the type and severity of secondary infection plays an important role. In patients with unilateral transplants where the recovering kidney has to compete with a normally functioning mate the principle of renal counterbalance comes into play. This principle must be taken into consideration in the evaluation of the functional reserve power of a kidney which has withstood the impact of ureterosigmoidostomy. Hinman in his discussion of the treatment of unilateral hydronephrosis emphasizes, that "stimulation to repair, even after the most highly successful treatment of the cause of the obstruction, is not so active or great as when this is the only kidney, or a similar condition or disease is present in the opposite side." This statement is in agreement with our observations which indicate that functional recovery of the injured kidney remained limited as long as function of the opposite kidney was unimpaired. However, it appeared from the results of functional tests that improvement continued as soon as the renal counterbalance was altered following the 2nd stage operation.

Our own experiences with intestinal implantation of dilated ureters are too limited as yet to permit final conclusions. However, it may be presumed that the impact of this operation on renal function will be less sudden and severe than in normal cases inasmuch as the kidney has already been exposed to pre-existing back pressure. Thus, it can be anticipated that additional alteration of the hydrodynamics will cause a much milder shock to the kidney which need not lead to renal insufficiency. Another factor reducing the adverse effects of ureterosigmoidostomy in patients with dilated but not fibrosed ureters is the fact that edema at the site of anastomosis will not obliterate the ureteral lumen nearly as readily as in a normal case. Even if extreme narrowing occurs it can be overcome more easily by the hypertrophied musculature of the ureter.

To what extent, if any, reabsorption of nitrogenous waste products from the large bowel contributes to the postoperative elevation of the blood nonprotein nitrogen remains problematical. In an attempt to evaluate the reabsorption theory the following factors should be considered: (1) the urine eliminated into the rectosigmoid is drained uninterruptedly through an indwelling rectal tube. Thus, its contact with the intestinal mucosa is not only of short duration but the continuous stage of collapse of rectum and sigmoid reduces the mucosal surface, from which reabsorption may take place, to a minimum. (2) If reabsorption played a major role in the development of postoperative uremia it is difficult to understand why the blood nonprotein nitrogen maintains normal values during the later stages when, following removal of the rectal tube, not only the rectosigmoid but also large segments of the colon are in continuous contact with urine. (3) The observation that it is possible to avoid elevation of blood nonprotein nitrogen by employing the Coffey II technique or by performing 2 stage operations rather suggests that a rise of the nonprotein nitrogen level occurs primarily as a result of kidney failure and not as a result of reabsorption of nitrogenous waste products from the large bowel.

Despite the fact that these studies have been confined as yet to only a limited number of cases it is apparent from an analysis of the results that the severity of the physiopathological changes produced in the kidneys varies with the type of ureteral transplant employed. Our investigations of the effect of ureterosigmoidostomy on renal function suggest the following pattern of risk: The surgical risk of a bilateral Coffey I operation is greatest because both kidneys are likely to suffer simultaneous functional imbalance during the initial postoperative period. This danger can be materially reduced by the use of a Coffey II procedure where catheter drainage offsets the

obstructing effect of edema at the site of the anastomosis as long as the catheters remain in place. However, 2 stage operations offer the greatest margin of safety because nitrogen balance will be maintained by the nonoperated kidney during the period of functional depression of the implanted side.

In consideration of these factors it is suggested that a bilateral Coffey I ureterosigmoidostomy should not be employed in patients with marked renal arteriosclerosis, advanced pyelonephritis, or any other disease which may have diminished the kidney reserve. While a Coffey II transplantation represents a safer procedure in these cases, it is felt that a two stage operation should be preferred in order to reduce the risk of postoperative uremia. In cases where the result of a first stage implantation is unsatisfactory it is advocated for the same reason to select the Coffey II technique for the second stage operation.

For the proper evaluation of renal functional efficiency following ureterosigmoidostomy it is of the utmost importance to realize that the volume of urine eliminated cannot be used as the sole criterion as to whether or not the kidneys are maintaining nitrogen balance. For this reason it is imperative, at least during the initial postoperative period, to carry out daily blood chemistry studies in order to recognize renal insufficiency at the earliest possible moment. Thus antiuremic therapy can be instituted before clinical symptoms of uremia develop, and before the patient becomes unsuitable for an emergency nephrostomy.

SUMMARY

A report of investigations dealing with the effect of ureteral transplantation on kidney function is presented. The results of these studies indicate that the extent of changes of renal functional efficiency depends primarily on the type of transplant employed:

1. No significant immediate kidney function impairment takes place following cutaneous ureterostomy.

2. Coffey I types of ureterointestinal implantation produce such a severe impact on renal function that the urine eliminated during the first 3 to 4 postoperative days may contain no or only inadequate amounts of nitrogenous waste products.

It follows that the urinary output alone cannot be considered a reliable criterion as to whether or not a patient is maintaining his nitrogen balance, and, in patients where functional deficiency persists over a prolonged period following a bilateral Coffey I operation, fatal uremia may ensue in spite of continued and apparently sufficient elimination of urine.

Partial recovery of kidney function takes place in these cases usually between the 4th and 6th postoperative days.

3. Coffey II types of ureterosigmoidostomy cause little or no suppression of renal functional efficiency during the early postoperative period.

The possible causes for the severe degree of functional derangement of kidney physiology which occurs following a Coffey I procedure are discussed, and it is surmised that edema at the site of the anastomosis is primarily responsible for the changes observed.

Accordingly, the following pattern of risk for ureterointestinal transplantation is suggested: The surgical risk of a bilateral Coffey I operation is greatest because both kidneys are likely to suffer simultaneous functional imbalance during the initial postoperative period. This danger can be materially reduced by use of a Coffey II procedure. However, 2 stage operations offer the greatest margin of safety because nitrogen balance will be maintained by the kidney not operated upon during the period of functional depression of the implanted side.

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THE BEHAVIOR OF BONE GRAFTS

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THE reports on bone grafting which have emanated from military hospitals during and following the recent war, have shown a rather constant adherence of their authors to the use of well established procedures (6, 9, 13, 14, 22, 29, 33, 36). These authors have reported a 5.5 per cent to 12.6 per cent incidence of failure following the first bone graft operation in their cases. In the main, they have used cortical bone, supplemented in some instances by cancellous chips or strips of bone.

The use of cancellous bone to reconstruct osseous defects and to supplement cortical bone grafts in the treatment of ununited fractures and in arthrodesing operations (2, 16, 17, 30), has evolved from the work of Matti, who, in studying the fate of bone grafts, used spongiosa from the greater trochanter and iliac crest because he believed that this type of bone became vascularized more readily than cortical bone (4, 30, 32, 34, 35, 43). Luckey and Adams utilized iliac bone in some of their later cases of ununited fracture of the long bones (27.4 per cent of 164 cases) in the form of strips placed along the fracture site. Gilson and Loadman, reporting their use of cortical and cancellous grafts in 105 initial bone graft operations with a 20 per cent incidence of failure, observed that in 23 cases in which iliac bone was used, either as slivers or as blocks with one cortical surface, the grafts united successfully in 88 per cent. It was their opinion that while cancellous bone became united more rapidly than cortical bone grafts, they required protection against injury for a longer time. Lambert and the writer (24) utilized iliac bone extensively in their military cases and they developed the use of massive iliac grafts which included one or more cortical surfaces, reinforcing the stability of these grafts by metallic plate fixation. In their second report, they (23) had begun to realize the deficiencies of this type of bone as graft material in certain localities and, also, they were limiting the use of the metallic plate to selected cases.

The recently published work of Abbott and his coworkers (2), defining certain new principles relative to the use of cancellous and cortical bone as graft material, appeared a little too late to be applied and evaluated on the wide scale possible in military war surgery. However, as the result of this report and by reason of his additional experiences, the writer's concepts regarding the use of cortical and cancellous bone as graft material have become more crystallized. Specifically, this experience has been derived from the following: 85 patients on whom 91 bone graft operations were performed in a military hospital, iliac bone having been used in 85 instances, cortical bone in 5 and both types of bone in one; 10 civilian patients with ununited long bone fractures in whom iliac bone grafts alone were utilized; and 25 civilian patients in whom cortical bone grafts had been employed in the treatment of the same lesion. Histologic studies were made on specimens, removed at the time of reoperation, of iliac bone grafts in 6 patients and cortical bone grafts in 2 patients.

THE NORMAL BEHAVIOR OF TRANSPLANTED CORTICAL AND CANCELLOUS BONE

In discussing massive bone grafts, reference is made to the dominant osseous component, for no large graft is entirely cancellous or cortical in its structure (Fig. 1).

It is generally agreed that most of the mature cells in a bone graft fail to survive the transplantation and that the only cellular elements which do survive are those which form the so called endosteal layer and a few elements in the cambium layer of the periosteum. The cells in these layers appear to have osteogenic properties. In a cortical graft the fully mature cells die and the only channels for the invasion of new vessels and newly formed bone are the Haversian canals and the surfaces in immediate contact with the host bed (38, 39). In the instance of a large cortical bone trans-

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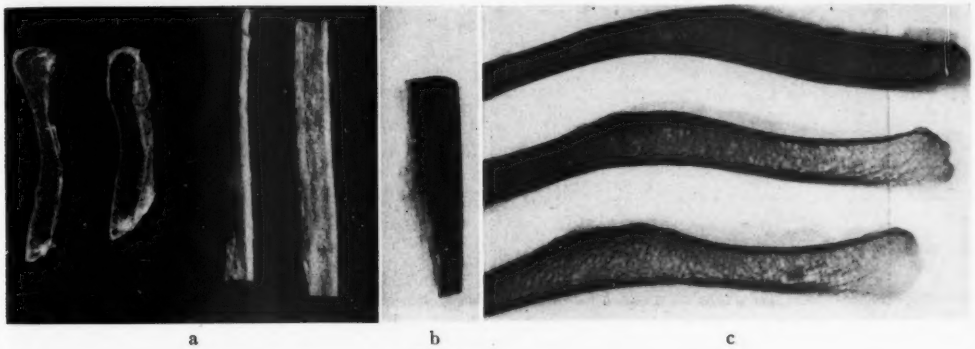

a b c

Fig. 1.

Fig. 1. a, Left two specimens, are sections through the wing of the ilium, showing its cancellous structure and the outer and inner cortical surfaces which give strength to this type of graft. This factor is well demonstrated in the roentgenograms of similar sections in c. The deficiencies of this type of graft are the limitation in its length due to the normal curvature of the iliac wing and its variable thickness. a, Right two specimens, are cortical grafts removed from the tibia and fibula respectively. Note that there is some spongiosa on the deep surface of the tibial graft, and this is illustrated well in the roentgenogram of a tibial segment in b.

Fig. 2. a, Ununited fracture of the ulna following a compound fracture incurred in battle, which had been treated by tibial grafting. Good union appeared to have been secured. There had been no postoperative complications or injury and the forearm had been splinted for 1 year. The center of the tibial graft has resorbed with recurrence of nonunion, 18 months following the initial bone graft operation. b, Nonunion of the femur with a gap-defect of several inches following a compound, comminuted fracture incurred in battle. The defect was bridged with a massive iliac graft fixed with screws, and by multiple sliver grafts, also from the ilium and placed in a previously prepared acrylic "trough." The lower extremity was supported in skeletal traction-suspension. There was no postoperative infection or injury. Six months later the grafts were observed to resorb and disappear, with recurrence of nonunion.

a b

Fig. 2.

plant, new bone is deposited at first largely on its surfaces, and, indeed, a densely sclerotic graft may become incorporated within the host bone without becoming fully replaced by new bone.

Entirely different conditions prevail in the instance of cancellous bone by virtue of its sponge-like architecture (Fig. 1). Here the open spaces contain cellular bone marrow and blood vessels and communicate freely, either directly or through fine apertures in the lamellae and trabeculae. What is more, each trabecula has its own endosteal layer. The situation in cancellous bone, therefore, is more receptive for survival of cellular elements and for early invasion and replacement by new bone, and while this pertains particularly to grafts which are small and thin, it is also manifest in the more massive type of graft. Although a portion of a massive cancellous graft will fail to survive, the peripheral portions remain viable while the more central portion becomes rapidly revitalized. On the other hand, such a massive graft from the ilium, by virtue

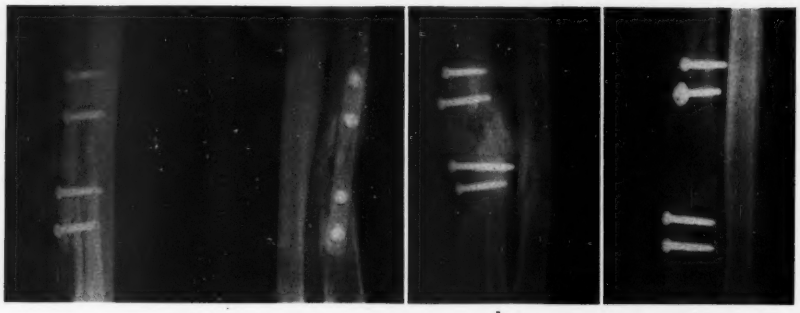

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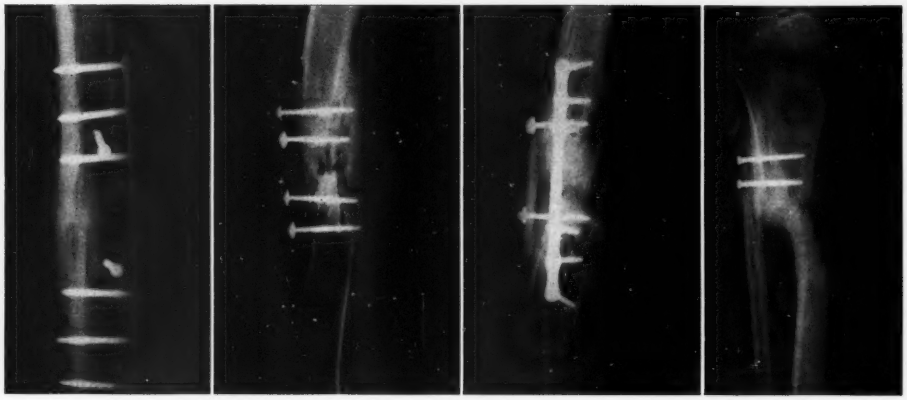
Fig. 3.



a b c d

Fig. 4.

Fig. 3. a, Ununited fracture of the radius following a compound battle fracture, treated by onlay cortical bone graft 3 months previously. Although the graft may be considered as united at its proximal and distal contacts with the shaft fragments, there is a distinct interval where it crosses the fracture site. b and c, Iliac grafts for ununited fractures of the radius following compound fractures incurred in battle, 6 months postoperatively. The distal end of the ulna was resected in both instances to permit repositioning of the radial fragments and correction of the associated radial deviation of the hand and wrist. Although the bone grafts in a, b, and c appear to be united to the host fragments, they still retain the architectural features of the donor bone. Until they assume features of the host bone, possibility of refracture must be guarded against.

Fig. 4. a, Ununited fracture in the middle third of the femur, complicating a simple fracture and treated 9 months previously by a massive iliac graft, iliac silver grafts and metallic plate fixation. The bony union is secure and the iliac grafts have begun to assume the architectural features of the host bone, i.e., a cortex and medullary cavity are now appearing. b, Compound fracture of the femur incurred in battle, with a gap-defect and a narrow bridge of bony union posteriorly. A reinforcing iliac graft was applied anteriorly and the defect filled with iliac slivers 3 months previously. Although the graft is beginning to unite to the shaft, it retains its original features. c, Nonunion of the femur complicating a compound battle fracture, which had been treated by a massive iliac bone graft and metallic plate fixation 5 months previously. It is now felt that cortical bone is preferable as graft material in the shaft of long bones where cortical bone normally predominates. d, Ununited fracture of the tibia following a compound battle fracture, treated by medial shifting of the upper fibular shaft following its osteotomy and transfixion by screws to the proximal tibial fragment, and the application of a massive iliac graft to the posterior surface of the fracture site without any screw fixation. The graft was not applied anteriorly because of soft tissue scarring in this area. Union of the tibial fragments is apparent 5 months postoperatively. The cancellous graft, seen in its distal portion between the tibia and fibula, is not too well incorporated, nor have the architectural features of the tibial shaft been reformed as yet.

of its one or more cortical surfaces, gives a good measure of stability and internal fixation.

Plastic surgeons (11, 19, 37) have observed that skull and facial defects, filled with cancel-

lous chips which are admirably suited for molding, feel firm as early as 10 days postoperatively. With the use of cancellous bone grafts, fixation of a small joint, such as the wrist, may become manifest, clinically, as early as 4 weeks following arthrodesis (without metallic fixation), while fusion of the spine or larger peripheral joints appears, radiographically, to be consolidating well by the twelfth postoperative week.

Until a bone graft, whether it is cortical or cancellous, becomes fully reconstituted by new bone of adequate strength, it may fracture or collapse, a complication which is observed even when the grafted part has been well protected (Fig. 2). This is a particular hazard where the graft is massive and has been used across the sclerotized fragment ends of an ununited fracture or to bridge a gap defect, and thus contacts little or no viable osseous tissue in its central portion (Fig. 2b). This "weak period" may occur later than the terminal second or the third month usually referred to (8, 15, 21). The writer has observed a case in which a massive cortical graft, employed to bridge a gap defect of the ulna in the presence of an intact radius, had fractured 18 months postoperatively, although there had been no injury or postoperative infection, and part had been protected by a splint for 1 year (Fig. 2a).

When cortical fragments unite across a defect which has been filled with cancellous bone, the transplanted bone appears homogeneous and retains its original features for a long time (Figs. 3 and 4). Until such an area differentiates into cortex and medulla, it is structurally weak and may give way. How long does this differentiation of cancellous bone take? The writer has observed the "ground glass" roentgenographic appearance of a cancellous graft retained for as long as 1 year. Abbott and his coworkers (3) studied the histologic specimens removed from 8 iliac grafts as late as 3 years following transplantation, and they observed complete differentiation in a tibia 1½ years postoperatively, and in an opponens thumb-strut 2 years following surgery. On the other hand, differentiation of a cortical bone graft in a bed of cancellous bone (for example, at the ends of long bones and in the spine) is also prolonged and, by roentgenographic standards, this may never fully occur. Such cortical struts, when massive and dense, may not become replaced by, but rather become incorporated within, new bone formation.

These findings form the basis for conclusions such as Abbott and his coworkers have arrived at. If an ununited fracture or incomplete osseous defect occurs at the end of the shaft of a long bone where spongy bone normally predominates, the type of graft employed should be predominantly cancellous. With adequate fixation and approximation of the fragments, these grafts will become rapidly and intimately incorporated within, and assume the features of, the host bone. At or near the center of a long bone where cortical bone predominates and where strength is required throughout a longer period of revascularization and revitalization, cortical grafts are preferred.

Cancellous chip grafts or sliver grafts, which become rapidly incorporated when employed where spongy bone normally predominates, are not advisable alone in the repair of long bone defects at or near the center of the shaft. However, in this area, a massive iliac graft with its one or two cortical surfaces will serve admirably when sufficient cortical bone is not available, or in order to spare one lower extremity when the opposite one is the site of operation. Such a graft is almost as rigid as a cortical graft of like dimensions, and it has the advantage of rapid incorporation by virtue of its predominant cancellous component. It has the disadvantage of limited length because of the normal curvature of the wing of the ilium, and of variable thickness (Fig. 1, a and c). The writer no longer favors the use of iliac grafts alone in the repair of a complete gap defect in the shaft of a long bone, but agrees that the dual cortical graft, supplemented with cancellous strips, is a more effective mechanical procedure (5) and is fraught with less likelihood of failure (6). Where possible, the defect in these cases would be diminished by shortening the extremity. The dual type cortical graft operation (7) tends to reconstruct the cortical walls and medullary cavity of the shaft. Cancellous grafts placed along the sides of or encircling the cortical grafts, line the latter with a type of bone which is more readily revitalized and which serves to reenforce the

major grafts, in turn hastening their revitalization and replacement by new bone. When the condition of the soft tissues will not permit the introduction of so much bone in one stage, the reenforcing cancellous strips could be inserted at a second stage, preferably preceding or during the resorptive phase of incorporation of the major graft.

There are sound arguments for and against the use of plate fixation at the time of the bone graft operation. Luckey and Adams believe that a metal plate encourages resorption of the graft by removing the effects of functional stress and strain which are necessary for the development and growth of the graft once it has become united in its bed. It is this local factor which has encouraged the use in some foreign clinics of the intramedullary nail as a method of internal fixation in the treatment of pseudarthrosis (44). Gilson and Loadman, on the other hand, suggest that the metal plate may prevent failure by taking away some of the strain from the bone graft. The writer now believes that metallic plate fixation is indicated specifically in the repair of osseous defects in certain anatomical areas, such as in the upper half of the femur and humerus where the lever action of the extremity may prove vicious (Fig. 4a, b, and c). The effectiveness of the internal fixation secured initially by metallic screw fixation of a large bone graft, becomes endangered during the resorptive phase of incorporation of that graft. Adequate support may be afforded in these cases by external fixation when the fracture site is within or distal to the lower part of the femur or humerus, especially in the presence of an intact bone adjacent the fracture site (for example, the fibula or a forearm bone), and particularly where there has been minimal soft tissue dissection during surgery (Fig. 3a, b, and c). Indeed, in these latter cases no internal fixation whatever may be required (20) (Fig. 4d). Where, however, reduction is difficult to maintain, the soft tissues will not hold the graft and internal fixation of the graft is necessary.

COMPARISON OF RED AND YELLOW MARROW CANCELLOUS BONE AS DONOR AND HOST

Clinically, cancellous bone containing red marrow, such as bone from a rib, the ilium or the greater trochanter, appears to be better graft material than spongy bone containing yellow marrow, as found in the ends of a long bone such as the tibia (30). This is fortunate, since both iliac wings offer an enormous amount of bone for transplantation, the removal of which need result in no disability (23, 24). Abbott and his coworkers (3) may be correct in attributing this difference between the osteogenic properties of both types of cancellous bone to the inhibitory effect of fat on the formation of new vascular tufts and new bone.

The experiments of Huggins and associates (25, 26, 27) are enlightening as to the distribution of red and yellow marrow. These authors demonstrated in rats that the occurrence of increased hemopoiesis, vascularity, and protein framework of marrow, was directly related to elevation in body temperature. Yellow marrow was found in those bony components furthest removed from the trunk—for example, in the tail and the extremities. Also, transplantation of these peripheral segments into the body wall or peritoneal cavity caused the transformation of marrow from yellow to red. In their experimental animals, actual intramedullary temperature measurements increased from the periphery of the extremities to the trunk. These findings are consistent with those in the human skeleton, where the cancellous bone of the osseous components of the trunk (for example, the sternum, ribs, vertebrae, pelvic bones, and the bony components of the shoulder and hip joints) contain red marrow, and the cancellous bone in the extremities (for example, the tarsal and carpal bones, and at the ends of long bones) contain yellow marrow predominantly.

What pertains to bone as grafting material also applies to bone as host material. Spongy bone is a more receptive host tissue than cortical bone; both types of host bone are more receptive to cancellous than to cortical bone grafts; and, finally, a cancellous bed containing red marrow may be even more receptive than a bed of yellow marrow spongy bone.

THE BEHAVIOR OF BONE GRAFTS IN THE PRESENCE OF INFECTION

As recently as 1944, Dickson cautioned against the use of a bone graft in the presence

of infection, even if low grade. Experience in the late war has shown that a bone graft may survive a complicating postoperative infection. For example, Luckey and Adams observed latent infection in 22 of 228 cases, yet union occurred in 17 of this infected group. In the writer's series of 91 bone graft operations (23), successful union occurred in 6 of 11 infected cases. Indeed, the use of chemotherapeutic and antibiotic agents has encouraged some surgeons to recommend the filling of draining, obviously infected, bone defects with cancellous bone chips, simultaneously with any necessary soft tissue repair (1, 10, 18, 40). Others are agreed, however, that it is less hazardous to use such grafts a suitable time following saucerization and temporary split skin coverage (28, 31, 41, 42).

In the reconstructive bone surgery of previously compound fractures, especially those which have been frankly infected, there is a hazard of recurring infection, during which the survival of transplanted tissue, particularly bone, becomes jeopardized. Cancellous bone appears more capable of withstanding infection than cortical bone, perhaps because of its greater permeability and more rapid revitalization (1, 18, 23). If infection occurs and is mild and if surgical intervention can be withheld or minimized, portion or all of graft may survive, and operation may still succeed.

The incidence of recurrent infection in these cases appears to be related to the "waiting period" between the time of wound healing following the original compounding and the time of reconstructive surgery. A period of 3 months or even less has been accepted by many as a safe interval prior to definitive surgery. Farrow, analyzing the incidence of 11.5 per cent infections in 156 bone graft operations for 137 cases with ununited fractures and 19 cases with limited union, 80 per cent of which had been compound, observed that the incidence of infection diminished rapidly as the "waiting period" was prolonged. This incidence was 40 per cent in 15 cases with a waiting period of 1 to 3 months, 20.5 per cent in 39 cases with a waiting period of 3 to 6 months, and no infection in 18 cases with a waiting period of 6 to 8 months. Lambert and the writer (23), adhering to a 6 month waiting interval, reported an incidence of recurrent infection in 12.1 per cent of their 91 bone graft operations. In view of these and other reports, a "waiting period" of 8 months or even longer appears advisable at the present time if the danger of relighting a latent infection is to be reduced to a minimum.

Further light has been shed regarding these recurrent infections by Lambert and the writer (23), who obtained positive wound cultures at the time of reconstructive surgery in 9 of 18 cases with ununited fractures of long bones, 6 months or longer after all wound healing. In all of these cases, chemotherapeutic and antibiotic agents had been utilized liberally at the time of injury, during wound healing, and in preparation for the reconstructive operation. Indeed, in 1 case healing had been present for 9 months and in another for 1 year. Eight of these 9 cases had been compound fractures and 1 case was a simple fracture which had been reoperated upon. In view of the inability, at this time, to determine accurately the presence of living bacteria prior to or during surgery, and to protect fully against this potential hazard, these authors have concluded that there will continue to be an irreducible minimum incidence of postoperative infection following reconstructive surgery of compound fractures. If a bone graft operation is to be performed and there is danger of relighting a latent infection, cancellous bone is preferred to cortical bone, since this type of bone appears more capable of surviving this complication.

CONCLUSIONS

1. Cancellous bone should be used as graft material to bridge or fill an osseous defect at the end of a long bone, where spongy bone normally predominates. At or near the center of a long bone, where cortical bone predominates and where strength is required throughout a longer period of revascularization and replacement by new bone, cortical bone grafts are preferred. There will be greater assurance of union in these latter cases if cancellous grafts are used to supplement the major cortical graft. Although the fracture fragments at or near the midshaft of a long bone, will unite when bridged with cancellous bone, it will take as long as 2 years for this transplanted bone

to assume the architectural features of the host bone, and during this entire period of transformation there is danger of its collapse or refracture. Cortical bone, on the other hand, when transplanted to a cancellous bed may never fully lose its original structural features.

2. Transplanted cancellous or cortical bone undergoes a phase of resorption during graft incorporation, and while this "weak period" has been noted usually at the end of the second and during the third months, it has been observed to occur as late as 18 months postoperatively. It is during this phase that refracture of the bone graft may occur.

3. The technique of the bone graft operation, i.e., whether dual-type, onlay, inlay, intramedullary, etc., and whether or not internal fixation is to be employed, will depend entirely on the circumstances analyzed in each case. In the presence of large osseous defects with nonunion, the dual-type of graft appears to be most effective mechanically and is fraught with less likelihood of failure.

4. Cancellous bone containing red marrow appears to have greater osteogenic properties than cancellous bone in which yellow marrow predominates. The iliac wings are the source for an enormous quantity of red marrow spongy bone, and a massive graft from this region has rigidity and strength.

5. If bone is to be transplanted and there is danger of relighting a latent infection, cancellous bone is preferred to cortical bone, because of its greater ability to survive this complication. Despite the use of chemotherapy and antibiotic agents, recurrent infection has been observed as late as 1 year following wound healing in a compound fracture.

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THE MEDICAL TREATMENT OF ENDOMETRIOSIS AND THE SIGNIFICANCE OF ENDOMETRIOSIS

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THE medical treatment of endometriosis has not as yet been proved to be of great importance. There can be no doubt that progression of the disease can be held in abeyance and its activity checked by medical treatment but the cure of such a lesion seems out of the realm of possibility. Miller of Hartford and Hirst of Philadelphia have presented experiences of considerable value in the use of testosterone. This hormone stopped the advance of the disease probably by inhibiting the activity of the pituitary gland as far as follicle stimulating hormone and luteinizing hormone are concerned, so that ovulation and luteinization and therefore an active, normal, ovarian-uterine cycle did not occur. It is also possible that the hormone may directly counteract the effect of estrin upon the proliferating cells of the endometrium. Miller reports that his case was made more easily operable but endometriosis was still present. It is unlikely that a pathologic state in which the lesion is often in an end-phase and which in many instances has taken years to develop would vanish following the use of any hormone. This hormone to be effective would of necessity have to be given over a period of years, for our experience on observing an adenomyoma of the rectovaginal septum following castration showed that 3 years elapsed before the lesion became white and puckered. Karnaky, judging from his personal communications with me, is very active in his advocacy of stilbestrol in the treatment of endometriosis. He states that the lesions vanish, that pain ceases, and that fertility results in many instances. He uses large doses of stilbestrol and has worked out a definite program for treatment. It is fair to say that the hormonal approach should be given every opportunity and its advocates should be encouraged to persist in their attempt to find a satisfactory treatment. However from the very nature of the lesion, that it is endometrium which is active but misplaced, any medical treatment to cure an endometrioma must cause inhibition of the hormones that activate it. Inasmuch as medical methods of treatment are in the experimental stage, it is not possible to advise their use at the present time.

Another form of medical or perhaps better called nonsurgical treatment is the use of radiation, either radium or roentgen therapy. This method of treatment is definitely curative and yet it is not recommended unless as a secondary treatment following a surgical excision that has failed, or in a lesion so extensive that surgery is considered too dangerous to carry out. Inasmuch as endometriosis is so frequent in the age group in which sexual activity is important it is unwise to use a form of treatment that causes the menopause to develop with its ensuing effect on sexual desire and satisfaction. It must not be forgotten that castration, whether surgical or following radiation, may cause serious changes in the metabolism of bone. About 20 years after the normal menopause, osteoporosis frequently occurs and it is reasonable to expect that 20 years after castration at the age of 30, that is at 50 years of age, real bone changes may occur. Unquestionably castration has an effect upon bone, skin, and hair; and for young people this method of treatment should be avoided if possible. Radiation is an easy, simple, and safe method of treatment but this type of therapy in youth is not being used so frequently as it has been, even in the group of patients who have small fibroids with bleeding or metropathia haemorrhagica. Radiation therapy can be used and it will be a most satisfactory method in a number of cases but its after effects are not desirable.

For these reasons this author is not satisfied with the use of medical treatment in patients with endometriosis. It surely will have its

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TABLE I.—TWO SERIES OF CASES TAKEN FROM PRIVATE AND WARD PATIENTS 8 YEARS APART

	Consecutive cases	Endometriosis microscopically		Endometriosis grossly		Endometriosis microscopically or grossly	
		No.	Per cent	No.	Per cent	No.	Per cent
Private Cases (1st series)	400	112	28	32	8	144	36
(2nd series)	400	122	30.5	18	4.5	140	35
M.G.H. cases (1st series)	400	21	5	11	3	32	8
(2nd series)	400	23	5.75	10	2.5	33	8.25

uses, and perfection of these methods of treatment will give the surgeon or gynecologist another arrow for his bow in the cure of a usually simple but sometimes very complicated lesion. We should encourage experimental trials but not advocate their use until further satisfactory reports have been published.

THE IMPORTANCE OF ENDOMETRIOSIS

The peculiar phenomenon (8) of endometriosis, which the author believes is a result of abnormal physiology and not a true disease or tumor, has certain effects upon young women that are far from desirable. Its ability to cause pain—both intermenstrual and during menstruation—is well known. The dysmenorrhea is usually of no serious consequence and its relief by the methods suggested recently by Dr. Counseller is obvious and not dangerous. Its advance however into the bladder, the bowel, or around the ureter is of serious consequence and its growth must be checked or the lesion removed. The cure of such lesions in these days of modern surgery is not too much to expect. However, its true importance is its effect upon the problem of reproduction. From previous studies of ward patients versus private patients it seems that the successful and educated stratum of society is most affected and this should be very important to us. We, as physicians, are in that stratum—intelligent, trained, educated, and socially minded—the so-called upper middle class as contrasted with the unsuccessful, impecunious and less educated group. This must not be misconstrued as an attempt to place us in the snobbish society group, but we are college men, university graduates, and are supposed to be intelligent and intellectual. Apparently it is our group of society, that marries late and limits the size of its families, which is most affected by endometriosis. It is our duty to reproduce ourselves, for according to many investigators only an occasional man or woman of large intellectual stature springs from the uneducated and supposedly not so intelligent class. It is from us, the really educated, that most of the superior minds develop. If this is so, and undoubtedly it is, it would appear that we should do our share of reproducing ourselves and not leave it to the other group. It has been shown that endometriosis is much more frequent in private than in ward patients (Table I) and therefore with the recognition of these facts and with our superior intelligence it would appear that the thinkers or more intelligent group should be interested in this problem. The importance of endometriosis is in its accompanying infertility among those who by their training and education attempt to plan their marriages on the basis of security from financial worries, and their child-bearing not upon biologic laws but the rules set down by the society in which they live. To these people conformity with the "Joneses" is more important than the production of the best children of the nation. Carrel in his famous book *Man the Unknown* states in confirmation of this brief discussion that "Eugenics is indispensable for the perpetuation of the strong. A great race must propagate its best elements. However, in the most highly civilized nations reproduction is decreasing and yields inferior products. Women voluntarily deteriorate through alcohol and tobacco. They subject themselves to dangerous dietary regimens in order to obtain a conventional slenderness of their figure. Besides, they refuse to bear children. Such a defection is due to their education, to the progress of feminism, to the growth of short-sighted selfishness. It also comes from economic conditions, nervous unbalance, instability of marriage, and fear of the burden imposed upon parents by the weakness or precocious corruption of children. The women belonging to the oldest stock, whose children would, in all probability, be of good quality,

and who are in a position to bring them up intelligently, are almost sterile. It is the newcomers, peasants and proletarians from primitive European countries, who beget large families. But their offspring are far from having the value of those who came from the first settlers of North America. There is no hope for an increase in the birth rate before a revolution takes place in the habits of thinking and living, and a new ideal rises above the horizon." Such a philosophy falls in with the facts of the studies carried out and reported previously. Private patients, and it is presumed that they are of more superior intelligence in most instances than ward patients, do not marry early enough and do not have sufficient numbers of children who can be brought up into healthy and strong sons and daughters. Carrel suggests that "The only way to obviate the disastrous predominance of the weak is to develop the strong."

THE SIGNIFICANCE OF ENDOMETRIOSIS

As a gynecologist interested in the problem of endometriosis and long aware that it is much too frequent, and interested and somewhat alarmed at the possible injury to us by the apparent frequency of late marriage and infrequent child-bearing, I have made repetitions of my thesis since its first presentation in 1938 in an editorial in SURGERY, GYNECOLOGY AND OBSTETRICS (9). A paragraph from Edwin Lawrence Godkin's *Problems of a Modern Democracy* quoted in a *Book-of-the-Month Club News* helps me to feel that repetition can be salutary. This paragraph states "No one ever talks freely about anything without contributing something, let it be ever so little, to the unseen forces which carry the race on to its final destiny. Even if he does not make a positive impression he counteracts or modifies some other impression, or sets in motion some train of ideas in some one else, which helps to change the face of the world. . . . One of the functions of an educated man is to talk; and of course he should try to talk wisely." This paragraph bolsters me in my repetition and perhaps it is a good excuse for repeating what has been written before.

In 1798 Malthus was distressed about the increasing population in the British Isles and his worry was based upon the theory that population increased by multiplication whereas the basic food supply increased only by addition. He apparently was in favor of marital continence, avoidance of marriage, pestilence, and war to keep the population within normal limits. It so happened that his worry was not necessary at that time for shortly after his essays were published the concentration of population in cities due to the industrial revolution was followed by a decrease in birth rate, although due to newer methods of hygiene and sanitation an increase occurred in the length of life. According to Vance, whose article "Malthus and the Principle of Population" I am using freely, contraception began to be used in France about this time with the result that the birth rate of that country dropped rapidly and kept the population stable in spite of the increasing length of life. There were just as many marriages in France but not so many children. This was the beginning of an attempt to control the birth rate and if it had been used everywhere plus the advent of hygiene and the subsequent increase in length of life the Malthusian idea might have been borne out. There is no doubt that something had to happen to save the world from overpopulation. Malthus thought that each married couple should have 6 children but modern demographers, or those interested in the study of population in relation to vital statistics and social statistics, believe that 3 children per family are sufficient. Six children per family if all lived, and in these days most would live, would quickly overpopulate the countries where hygiene, sanitation, and the like are part of modern civilization. Something needed to be done about the population, and contraception, late marriage, and infrequent child-bearing were aided by two very great wars. Ireland is an example of the working of the Malthusian theory for here the population is kept at 4,500,000 and overpopulation is avoided by late marriage, by the entrance of many sons into priesthood and of daughters into the sisterhood, and by the largest percentage of unmarried and therefore unproductive women in the world. Birth control is not used in this Catholic country but stabilization of the population has been achieved.

TABLE II.

	Per married couple reporting
All colleges, women, class of 1923	1.66
Harvard, class of 1922	1.83
All colleges, men, class of 1922	1.85
Mills College, California (women), class of 1923	1.88
Princeton, class of 1921	1.90
Occidental, California (women), class of 1923	1.94
Private patients (J.V.M.)	1.94
Massachusetts General Hospital doctors	2.70
Massachusetts General Hospital outpatients	3.31
*Women with not over 4 years' schooling	4.33

*This is very high for even including the unmarried they had produced 4.33.

It is interesting to note what patients in the private practice of a gynecologist do about increasing the population. The last 200 patients were questioned as to whether or not they used contraception and the results show that over 90 per cent use contraceptive methods of one sort or another. In my private practice 200 married couples, who at this time were over 38 years of age, had produced 389 children or 1.94 per couple. Further information showed that in the Gynecologic Out Patient Clinic of the Massachusetts General Hospital 196 successive patients had 650 children or 3.3 children per married couple, a little less than twice the number produced by private patient couples. Dr. Clarence Gamble (1, 3) of the Population Reference Bureau discloses that married college women graduated in 1923 had but 1.66 children in 1948 and that married college men had 1.85 children. The graduates of Princeton and Harvard, 25 years out of college, fathered but 1.90 and 1.83 children respectively, while the total number of women with not more than 4 years' schooling averaged 4.33 children. This must mean, therefore, that in our intelligent and successful class of society the deliberate avoidance of large families is the rule. Thus we are enthusiastic Malthusianists and our group is gradually becoming smaller while the less educated group becomes larger. It must be admitted here that 100 unselected doctors of the staff of the Massachusetts General Hospital, with their usual intelligence and farsightedness, have been an exception to these figures for these married couples who have reached 38 years of age have had 2.7 children per couple, a very satisfactory accomplishment (Table II).

Unquestionably limitation is important to society but the mistake is the use of birth control in patients who have married late and in patients who have produced but 1 child. It is the feeling of this writer, and this has often been repeated, that our children should marry young and they should have their families when young. After this has been accomplished they can then practice prevention of impregnation. I am definitely against giving contraceptive advice to patients who are young and can afford to have children. I am against giving it to newly married women over 25 for it is my belief that these are the patients who, by not using their reproductive organs and by allowing their menstrual cycles to continue uninterrupted for 12 to 14 years, develop endometriosis with its important bearing upon fertility. An ovary that is adherent or a tube that is adherent, a complication of endometriosis, certainly is a definite deterrent to conception. Again to be repetitious (7) it is my feeling that we as parents should give financial aid, if we can, to our children and encourage them to have babies. The modern young married couple gets along on very little. These children of ours are the type that are important to the world. It is not large families of the poor, the unhealthy, the weak, and the unintelligent that the world needs, but families of the healthy, strong babies of our children. With a slight amount of help we can prevent the sad occurrence of our children seeking advice and help for a sterility problem that may be insoluble.

That this philosophy can lead to the ridiculous is obvious. I have a letter from a surgeon in Worcester, Massachusetts which is so apropos that I would like to quote a paragraph. The doctor writes after reading a similar article to this one in the *Annals of Surgery* for May, 1948 "I warn you I read it with a shudder and will delete all references to parents helping their children financially so that they may marry young. My case history and a little mathematics are sufficient to precipitate a psychosis at the very thought. Even though I was one of those poor benighted souls who put in a long period of training and did not marry until I was 32, my score at the box office at present is 7 children. My wife is only

43. . . . . If, in order to prevent endometriosis, I encourage the early marriage of my children with the responsibility in the background of education in private schools, colleges, and universities, I may have to borrow some money from you. If the larger physical growth of the present generation of children is paralleled by a corresponding increase in fertility, and they can ring the bell at 8 children each, I soon would have an extension of the endometriosis program to apply to 56 children!" This is a delightful commentary from a very wise and friendly surgeon, and how correct he is! But I hope all his sons will be older and established and marry young wives, as he did, and then they will be able to care for them even as the doctor has. Not all young men want to marry out of their own age group and this is the problem that is before us. Not only do I think that we should help our children financially but that industry might be able to give more wages to the young married man so that he can have children when young and healthy.

The Malthusian theory is working out among us but war and pestilence are not our methods for we prefer the use of contraceptive methods which are satisfactory in their place, which is not with the young married couple until they have produced their offspring.

A look at Table I showing the incidence of endometriosis in the private and ward patients should convince each of us of the seriousness of the problem of endometriosis and should warn all of us that our young are too precious to be sacrificed in these difficult economic days. Malthus was correct and we must pay attention to his ideas but let us not carry them out too rigorously in our educated and supposedly intelligent group!

The importance of endometriosis is its aspects and relation to infertility, and its significance is that we as parents, recognizing the facts, can help to increase the most necessary class in society and aid the world in becoming a healthier and better place.

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SURGICAL PROCEDURES INVOLVED IN THE TREATMENT OF ENDOMETRIOSIS

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THE surgical treatment of endometriosis is both of a radical and of a conservative nature. However, before presenting to you the ideas of my colleagues and me concerning some of the surgical procedures required in the successful management of this interesting entity, let me repeat what I have so often said, "There is no pelvic operative procedure which at some time is not required for endometriosis or made more difficult by its presence. Few conditions demand more surgical skill and judgment to secure the best way out of an unfortunate situation for the patient."

It seems to us that extreme caution must be used in making a decision that a patient suspected of having endometriosis has now reached the point at which she requires surgical treatment for relief. This is a simple matter if one is dealing with large chocolate cysts of endometrial origin or if there are associated pelvic pathologic conditions which of themselves need surgical treatment. I refer especially to those younger patients who complain of dysmenorrhea and who may have some slight fixation or immobilization of one adnexa or tender and tense uterosacral ligaments. One of the chief symptoms of the younger patient is menstrual pain, uncontrollable and of an increasing character. Usually in a few years there will be superimposed on this some type of menstrual disturbance and in the young married patient, there is the question of sterility. If therefore, the pelvic findings are not remarkable and definite on pelvic examination, one should be quite hesitant in advising surgical treatment and, what is more, should be quite cautious in evaluating the results which may be obtained if the patient accepts surgical treatment. However, it is an entirely different matter when the pelvic findings are definitely those associated with extensive endometriosis or if this is associated with other pelvic lesions such as fibromyomas, ovarian cysts, hydrosalpinx, and so forth.

This word of caution is injected here to try to prevent, or at least to defer, early surgical intervention in some of these young women because we have noted that there is such a variation in the threshold for pain among them, and that clinicians so frequently will make a diagnosis of endometriosis on the basis of menstrual pain alone. Certainly, by no means is endometriosis responsible for all the pelvic pain ascribed to it. There are, however, definite physical findings which are familiar to the trained gynecologist and which denote only endometriosis. These should be entirely familiar to anyone who attempts to treat surgically such an important pathologic entity in women, which is so intimately associated with their pelvic comfort, their marital relations, and their reproductive capabilities. A discussion of the physical findings in this disease is not to be incorporated here.

As a basis for discussion of the surgical procedures a series of 852 patients in whom operation was performed from 1940 through 1945 will be used. Also, I shall refer in addition to some of the difficulties inherent in performing the common pelvic operative procedures in the presence of endometriosis.

It is particularly interesting that in this group of patients only 6.2 per cent were less than 30 years of age, while 81.7 per cent were from 30 through 49 years of age (Table I). This, I believe, is the correct trend and is indicative of our efforts to allow the younger patient to carry on with her disability providing it is not too incapacitating. If she marries, it is to be hoped that she will have children before it becomes necessary to intervene surgically, because there is increasing evidence that surgical intervention on the uterus in patients who have a few endometrial implants does in-

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TABLE I.—AGE INCIDENCE

Age, years	Number	Per cent
10–19	2	0.2
20–29	51	6.0
30–39	311	36.5
40–49	385	45.2
50–59	99	11.6
60–69	4	0.5
Total	852	100
Mean age		41.3 years
Youngest		19 years
Oldest		69 years

TABLE II.—PREVIOUS SURGICAL TREATMENT

	Number	Per cent
Previous surgical treatment, total cases	369	43.3
Surgery of uterus or adnexa	235	27.6
Dilatation and curettage, perineal surgery	74	8.7
Other abdominal surgery	60	7.0
No previous surgery	483	56.7
Total	852	100

fluence a secondary sterility. Patients who undergo operation after 40 years of age usually have other associated pelvic lesions in addition to the endometriosis.

It does seem that the pelvic structures and peritoneum of some women are different from those of others in that they do not tolerate manual manipulation or any surgical trauma. Each of you has seen the excessive contraction which occurs in the uterus of some patients when it is handled at operation and the vascular flush which also is easily induced in the peritoneum of the cul-de-sac and broad ligaments if they are subjected to the slightest trauma. These structures actually behave in the same manner as the cornea when it is touched or irritated.

Since endometriosis seems to be definitely increasing, every precaution should be taken at least on our part to prevent its occurrence. Nonsurgical intervention in the female pelvis except for acute emergency conditions may be quite helpful, since the incidence of endometrial lesions seems to be definitely increased by previous surgical procedures. In this series of 852 patients studied, 369 (43.3 per cent) had undergone previous pelvic and abdominal surgical procedures. However, only 7.0 per cent had undergone abdominal surgical procedures on structures other than the pelvic organs. Surgical procedures involving the uterus itself or its adnexa had been performed in 27.6 per cent of the cases, and dilatation and curettage and perineal surgery had been done in 8.7 per cent (Table II). Whether this is a definite factor in the causation, of extreme surgical significance, cannot be said for certain but it can be said, I believe, without question that there is considerable variation in the degree of sensitivity of the pelvic organs among women.

Whenever surgical treatment becomes indicated for endometriosis, it is on account of menstrual pain, menstrual dysfunction, sterility, associated pathologic lesions of the pelvic organs or a combination of two or more of these factors. The extent of the surgical treatment required will depend entirely on the extent of the endometrial process.

We all know that endometriosis is functioning endometrium or endometrium-like lesions in an ectopic position. Its activity is synchronized with that of the normal endometrium, so that to secure a surgical cure the ovaries, which control the activity of the endometrium, must be removed or the endometrial lesions must be excised.

The longer that surgical intervention can be postponed, the better it will be for the patient, because it is not possible to estimate before operation how extensive the procedure is going to be. If the patient is less than 35 years of age, perhaps one can perform a conservative operation and maintain both the menstrual and reproductive functions, a result which is highly desirable. However, maybe at operation it is obvious that this cannot be done without the possibility of early return of the same symptoms and difficulties. For this reason it is mandatory that the surgeon be given permission to do a radical removal of all pelvic organs if in his judgment this appears to be advisable at the time of pelvic exploration. Most young women who thoroughly understand these facts and who understand how this pelvic situation functions will not submit to surgical treatment under these circumstances

TABLE III.—PRESENT SURGICAL TREATMENT

Type of treatment	Cases	Per cent†	With presacral neurectomy	
			Number	Per cent‡
Radical surgery	742	87.1		
Conservative, total*	110	12.9	10	9.1
Tubal operation	2	0.1		
Oophorectomy	27	3.2	5	18.5
Salpingo-oophorectomy	51	6.0	3	5.9
Local excision	27	3.2	2	7.4
Bowel resection	3	0.4		

*Operations concerning menstrual function.
†Per cent of total cases.
‡Per cent of cases with listed treatment.

unless they are indeed having serious disability and desire relief above everything else.

There is a situation which seems contradictory to what I have just said, and I believe that it should be briefly stated here. Occasionally you will encounter a patient whose ovaries are quite free of endometrial lesions, but it is impossible to excise completely all the implants on the broad ligaments and peritoneum of the cul-de-sac. My colleagues and I hesitate to perform castration in this type of case, but we usually perform a subtotal hysterectomy since we have found that, if the patient does not menstruate, the remaining implants stay relatively quiescent even though the ovaries are still functioning. I cannot give a good reason for this behavior except to say that it resembles some malignant implants or metastatic growths which remain quite inactive for several months or years after removal of the parent growth. Hysterectomy in a young woman must be considered radical treatment but not as radical as though bilateral castration were done also.

We feel that it is vital to the patient's welfare to conserve ovarian tissue and prolong ovarian function as long as it is possible, because some of the effects of sudden cessation of ovarian function are about as detrimental and as difficult to manage as the original disease itself. Some of these conditions briefly are atrophy and increased sensitivity of the vaginal mucosa, loss of muscle tone, and other evidences of early senility. However, fortunately, in some instances in which it is necessary to perform castration, the effects are not as severe as is common in castration for other reasons. Many of these patients will have few if any symptoms. This phenomenon is explained in part by the fact that the gradual destruction of ovarian tissue by the endometriosis has progressed, at the time of operation, to such an extent that the patient has been bordering on menopause for some time. Therefore, in this condition patients who are in the age group of 35 years or older will begin to have evidence of ovarian dysfunction and menstrual disturbances.

If the foregoing statements and observations are correct and they are applied in the selection of patients for surgical treatment, it will be noted that a greater number of the patients will be treated by more radical means and that surgical treatment will be delayed until the middle or later part of the thirties. Our studies in this group of patients show that 742 (87.1 per cent) were treated by radical surgical measures, which, generally speaking, means a complete removal of all pelvic organs except in the case of those patients who have diffuse lesions in which the ovaries are uninvolved (Table III).

Conservative operations, which were, of course, directed at relief of pain and preservation of menstrual and reproductive functions, were performed in 110 patients (12.9 per cent of the total cases). Of these, 10 (9.1 per cent) underwent presacral neurectomy in addition. This was combined with excision of the accessible implants in 2 patients, excision of one adnexa in 3 patients, and the removal of one ovary in 3 patients. Owing to careful selection of patients the results of presacral neurectomy have been excellent.

If a presacral neurectomy is to be done as one of the conservative measures, it should be limited to those situations in which the lesions are confined mainly to the uterus, uterosacral ligaments, and vesical tissues. If the lesions are on the parietal peritoneum or intestines they are not affected by this procedure. Furthermore, it is not a procedure to be undertaken hastily, and it must be carefully executed, especially in securing the branches which pass downward along the left common iliac vein, if one is to avoid severe hemorrhage.

It must be remembered too, that this nerve can regenerate completely within 3 to 5 years and have all the sensitivity restored.

Menstrual abnormality in endometriosis is rather high and is one of the symptoms which the patient is most anxious to have corrected. In this series 688 patients (81 per cent) complained of some type of abnormality. Some of these abnormalities were not due to any gross pathologic change in the ovaries but were attributed to ovarian-pituitary and thyroid imbalance or dysfunction. However, in 496 patients (58 per cent) there was menorrhagia or metrorrhagia which could be directly attributed to endometrial or other lesions of the ovaries and uterus. From this, one can assume that about 58 per cent of the patients at least will require surgical intervention for adnexal or uterine lesions which most likely are producing the menstrual disturbances.

The dysmenorrhea which these patients complain about is variable and, as previously referred to, must be carefully selected if the surgical intervention is primarily for the relief of pain. Patients may have extensive lesions without much pain, as was the case in 145 patients (17 per cent). Many of these lesions are in conjunction with large fibroids and for some reason are relatively painless. This same situation obtains in cases of large endometrial chocolate cysts, in which all ovarian tissue is about destroyed from pressure of the old blood. In these situations also there is not much pain. On the other hand, one or two small implants properly situated on the uterosacral ligaments can produce severe dysmenorrhea and, if one is to be conservative in one's surgical approach, it is most difficult to know which lesions are producing the pain.

The question of fertility in these patients is most interesting and in many it is the chief symptom which brings them to the gynecologist. What part the endometriosis plays in this is certainly problematical. It is true, however, that 30 to 50 per cent will have a primary sterility problem. In this group of patients 737 were married and in 215 (29.2 per cent) of them there were no pregnancies recorded (Table IV).

TABLE IV.—FERTILITY OF 737 MARRIED PATIENTS*

	Cases	Per cent
Total	737	100.0
No pregnancy	215	29.2
Pregnancy, all cases	506	68.6
One live birth	162	22.0
Two or more live births	290	39.3
Miscarriage only	54	7.3
No information	16	2.2

*115 patients unmarried not included.

It is of interest that in some of these patients infertility develops after 1 or more pregnancies. For example, only 32 per cent of those becoming pregnant had fewer than 2 live births and 57 per cent became infertile after the delivery of 2 or more children. The reason for this certainly needs careful study and consideration, for it does appear that if one of these patients does become pregnant it may have something to do with subsequent infertility. It is known that 100 per cent of patients who have diffuse uterine adenomyosis (internal endometriosis) have had children, so that perhaps it may be the trauma which causes the endometrial cells to invade the myometrium. When this situation ensues, dysmenorrhea becomes progressively more severe, the uterus becomes usually somewhat enlarged and the patient becomes sterile or aborts when pregnancy occurs. The cure in these cases is hysterectomy.

A word of caution should be expressed concerning the results of conservative operations in an attempt to correct the sterility. Our records show that not more than 10 per cent of those who have been treated surgically will later become pregnant. Therefore, the chances of future pregnancy occurring are probably just as great if the patients are left alone.

The difficulties which surgeons have in doing any pelvic operations where endometriosis predominates are explained on a sound and correct pathologic basis. The endometrium and its stroma cells are among the most rapidly growing and repairing tissues in the body. The stroma cells and the surrounding tissue which they stimulate form dense fibrous adhesions. The tarry material which is periodically spilled into the pelvis contains blood, tissue debris, and glycogen. It is far more ir-

ritating and causes denser and tougher fibrous adhesions than does the inflammatory reaction from specific infections or fecal fistulas. Also, the endometrial cells invade the muscular walls of the intestine and the peritoneum overlying the ureters, bladder, and uterus, a fact which accounts for the inability of the surgeon to separate the intestine by any means other than sharp dissection. This fact clearly explains why there is a rather high incidence of fecal fistulas subsequent to surgical intervention for endometriosis.

Given a case of extensive endometriosis with chocolate cysts and uterine fibroids which requires removal of all pelvic organs for a cure, the operation is generally a very difficult procedure and, unless meticulous care is used, complications such as vesicovaginal fistula, ureteral injuries, intestinal fistulas and obstruction will occur. The type of hysterectomy should be a supracervical one because in this disease the paracervical tissues are involved in the endometrial process which has resulted in formation of considerable scar tissue with fixation of the cervix and the lower ends of the ureters. The ureters in this region become fixed to the peritoneum and covered, and if one elects to do a total hysterectomy these structures do not drop away in the usual manner. Injury of a ureter usually takes place about 1 inch (2.5 cm.) above the ureterovesical juncture. One of the most common injuries to the ureter is interference with its blood supply so that a portion of the ureteral wall sloughs out and a ureteral fistula then develops.

There are three other complicating lesions of endometriosis which become surgical problems, so that their management must be included in this discussion. The first of these is endometrioma of the urinary bladder. The symptoms are hematuria as well as other symptoms of vesical irritation at the menstrual period.

Cystoscopic examination and a biopsy will reveal the nature of the lesion usually, although not every time. Occasionally the pathologic diagnosis of an inflammatory lesion is made, a result which leaves one to wonder if the lesion is a malignant one associated with marked inflammation. Repeated biopsies should settle the issue. This is important, since the management of these two lesions is entirely different and the prognosis is profoundly different.

An endometrioma, such as of the bladder, is an instance of one benign tissue invading a normal tissue. Complete surgical excision cures the patient. However, to perform a complete excision is best done when the endometrioma is congested with blood. At this time its extensions can be more easily identified. Many of these endometriomas of the bladder are solitary lesions so that no other surgical treatment on the pelvic organs is required.

Another type of endometrioma which may cause more serious trouble is an endometrioma of the sigmoid. Fortunately, these lesions are not all obstructive and do not all require resection of the bowel. The sigmoid is usually involved in extensive pelvic endometriosis but, if the bowel is not obstructed, the lesions on the bowel will regress with complete removal of the ovarian tissue. But if partial or complete obstruction has already begun, then castration alone is not sufficient and one must proceed with colostomy, segmental resection, and anastomosis.

Finally, there are some implantation endometriomas other than those in abdominal scars or in the umbilicus which are more difficult to attack surgically. These are the implants which develop in the suture line of the vaginal vault subsequent to vaginal hysterectomy, those that occur in the scar of a repaired perineum and those beneath the bladder where a cystocele had been repaired. These lesions become very troublesome and produce marital disturbance to such a degree that excision of the lesions are necessary. Since these lesions do occur, they cause a simple dilatation and curettage to assume considerable importance if the patient is to undergo vaginal hysterectomy or vaginal repair or if both are to be carried out.

To summarize the surgical treatment of endometriosis briefly, one must conclude that it is much better from every point of view to delay surgical intervention in this disease as long as possible unless it is obvious that one is dealing with associated lesions of the uterus

and adnexa which in themselves require surgical treatment. Conservative operations for the relief of dysmenorrhea and menstrual disturbances and the correction of infertility should be undertaken only after careful consideration and a full discussion with the patient, her parents, or her husband, as the case may be. Radical surgical treatment is the most effective means and the end result will be a greater number of satisfied and cured patients.

Surgical procedures in the pelvis for endometriosis are always more difficult than the usual ones, because of the dense fibrous adhesions which it produces. Injury of the intestines, ureters, and bladder is to be avoided by the surgeon having a more complete acquaintance with the nature of endometriosis, and always keeping in mind that this is a specific example of one benign tissue invading another. Complete cure is effected by local excision of solitary lesions or castration in diffuse types.

THE RADICAL MASTOIDECTOMY

Anatomical Considerations in Surgical Technique

J. BROWN FARRIOR, M.D., F.A.C.S., Tampa, Florida

THE present day renaissance in otological surgery is, at a superficial glance, associated only with the endaural incision and the fenestration operation, technical procedures aided by the electrically driven burr and magnification. More careful study of the developmental period of this renaissance will reveal the evolution of sound clinical anatomical knowledge of the temporal bone, accurate to the finest microscopic detail. Attention to this anatomical detail is essential in all otological surgery.

According to Boies, the objective in the radical mastoidectomy is to remove the disease and, thus, the danger to life and to preserve as much hearing as possible. However, the patient will measure the results in terms of a dry ear.

The success of the radical mastoidectomy, as measured by a cured patient with a dry ear with maximum hearing, is dependent upon the minutely accurate surgical technique in the exenteration of the disease and upon the meticulous postoperative care of the cavity. Toward this goal, I want to stress two anatomical considerations in the dissection of the middle ear, to outline the procedure of the radical mastoidectomy, and to advocate the primary skin graft as an aid in facilitating the accurate healing of the mastoid and middle ear cavities.

ANATOMICAL CONSIDERATIONS

Among the many potential minute imperfections in the radical mastoidectomy, which may result in persistent suppuration, are residual foci of infection in the epitympanum, the hypotympanum, and the tympanum proper, including the eustachian tube orifice. In my opinion, the most frequent causes for this persistent suppuration are, first, residual disease foci in the hypotympanum and, second, inaccurate or officious surgery of the tympanic orifice of the eustachian tube. At the onset of this presentation, I want to describe the anatomy of the hypotympanum and the eustachian tube orifice.

Hypotympanum. Anatomically, the hypotympanum is bounded externally by the rim of the annulus tympanicus and the infra-annular mass of bone which constitutes the floor of the external auditory canal. As illustrated in Figure 1, this infra-annular mass contains no important structures anterior to the facial nerve. The height of this external wall will vary with the depth and the cellular development of the hypotympanum. In the radical mastoidectomy, this infra-annular mass must be lowered to the level of the depth of the hypotympanum or there will result a hypotympanic pocket. Further, this infra-annular mass must be removed to complete the accurate dissection of the medial wall of the hypotympanum. On the medial wall of the hypotympanum (Fig. 2) are the jugular bulb posteriorly and the carotid artery anteriorly. Together, these structures form a V, in which rests the promontory of the cochlea.

The pneumatization of the hypotympanic cells is highly developed in the anthropoid apes and is rudimentary in man. Inferiorly, the hypotympanic cells are superficial and are easily exenterated after the removal of the infra-annular mass. Posteriorly, the hypotympanic cells may extend medial to the facial nerve and, as pointed out by Almour, are usually responsible for the retrofacial and infralabyrinthine cellular development. Medially, the hypotympanic cells may extend through the V formed by the carotid artery and jugular bulb to pneumatize the petrous apex. Anteriorly, the hypotympanic cells are continuous with the peritubal cells. In the radical mastoidectomy, these potential routes of cellular development must be explored, even though the mastoid, itself, is sclerotic.

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The eustachian tube. Guilty or not guilty, the eustachian tube has long been "the accused" when persistent suppuration follows an inaccurate radical mastoidectomy. Many articles have been written, describing methods of corking up the eustachian tube, and many instruments have been devised for stenosing of the eustachian tube at the isthmus. In the radical mastoidectomy, all accessible disease must be removed from the tympanic orifice of the eustachian tube. However, with the most thorough dissection, there will invariably remain some inaccessible diseased peritubal cells, granulation tissue, and mucous membrane which, postoperatively, may continue to suppurate or form mucus. If the eustachian tube is patent at the isthmus (Fig. 2), this normal mucoid discharge, or any minor suppuration, will continue to flow down its normal channel into the nasopharynx. However, if an attempt is made to cork up the eustachian tube with the tensor tympani muscle or to stenose the eustachian tube at the isthmus with the Jensen or Yankhauer curets, this residual disease will backfire into the middle ear, producing a so called tubal ear. It is, therefore, my practice to exenterate all accessible disease at the tympanic orifice of the eustachian tube but never to attempt to produce a stenosis at the isthmus. A eustachian tube so treated will seal itself at the tympanic orifice.

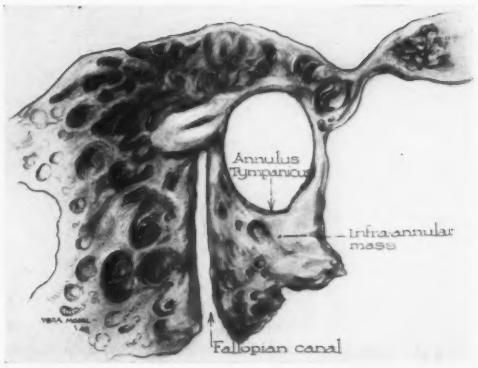

Fig. 1. A sagittal section through the annulus tympanicus reveals the dense area of cancellous bone which forms the floor of the external auditory canal. This "infra-annular mass" is the external boundary of the hypotympanum and must be lowered to the level of the depth of the hypotympanum to prevent a pocketing of hypotympanic disease.

OPERATIVE PROCEDURE

The mastoid cortex is exposed through the incision of the operator's choice. It may be postauricular or endaural. The endaural approach is now generally preferred because of its simplicity, the direct avenue of approach to the antrum and middle ear, the minimal bleeding, the perfect orientation, the minimal trauma to the soft parts, the improved exposure of the tympanum, the absence of trauma to the cartilages, the free postoperative drain-

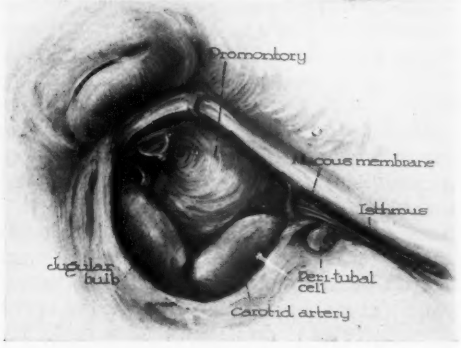

Fig. 2. All accessible disease is removed from the hypotympanum and tympanic orifice of the eustachian tube. Within the eustachian tube, there will invariably remain mucous membrane, granulations, and peritubal cells which will discharge into the nasopharynx if the isthmus is patent.

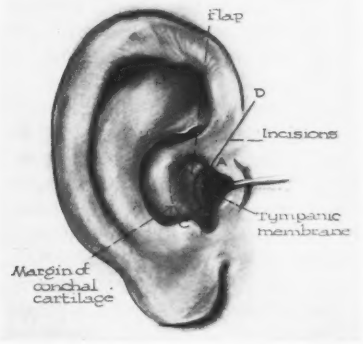

Fig. 3. The endaural incision (as illustrated *A*, *B*, *C*, – *A*, *D*) preserves the skin of the canal, prevents stenosis of the canal, protects the margin of the conchal cartilage and aids in epithelization. The dotted line indicates the margin of the conchal cartilage; it is not an incision.

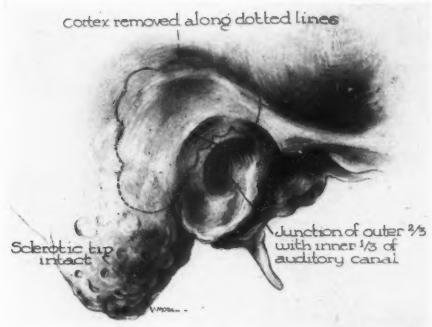

Fig. 4. Direct approach to mastoid antrum, with simultaneous removal of cortex of outer two-thirds of posterior superior bony walls of external auditory canal and neighboring mastoid cortex, performed with burrs or with gouge.

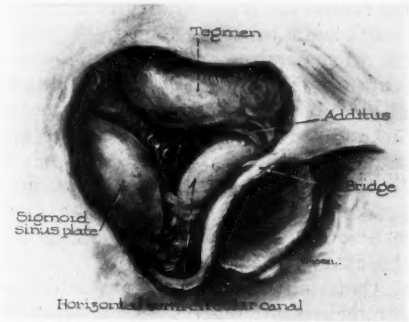

Fig. 5. Demonstrates the internal landmarks of the sclerotic mastoid cavity, with the cortex removed. Note the relative superior position of the mastoid antrum to the external auditory canal.

age, the ease of postoperative dressing, and the reduced period of hospitalization.

Hoople, Lathrop, Tolan, and others have modified the Shambaugh (11) incision, preserving the skin of the canal and removing the subcutaneous mass of tissue and periosteum. I prefer this modified incision, believing that the preservation of the flap aids in preventing stenosis of the external auditory canal and facilitates the epithelization of the cavity.

The incision is begun at 12 o'clock, deep in the external auditory canal. At the same depth in the canal, the incision is carried from 12 o'clock around the posterior rim of the canal to 7 o'clock (right ear; 5 o'clock in left ear). The incision is then downward and outward to the rim of the cymba concha. The second incision begins at the original point, 12 o'clock, and is carried vertically upward through the periosteum to the rim of the temporal muscle and then superficial to the temporal muscle, between the helix and the tragus, as in the Lempert (7) incision. The skin and periosteum are then elevated from the cortex of the outer one-third of the bony wall of the external auditory canal and the mastoid. The pedicle, thus created, is grasped at its inner extremity with an Allis forceps and the epithelium elevated from the subcutaneous tissue. The subcutaneous tissue, excised along the margin of the conchal cartilage and the inferior border of the temporal muscle, is discarded. The epithelium preserved as a flap covers the rim of the conchal cartilage and prevents stenosis of the auditory canal. This incision is little more than the endaural modification of the classic Koerner flap.

The inner one-third of the cutaneous lining of the external auditory canal is then reflected from the bony wall, the notch of Rivinus and the posterosuperior limit of the annulus tympanicus (as with the fenestration flap). In this way, the surgeon is immediately oriented as to the depth of the epitympanum, the annulus, and, thereby, the depth of the facial nerve.

The mastoidectomy. Regardless of the incision used, the mastoidectomy begins with the direct approach to the mastoid antrum. The cortex of the posterosuperior bony canal wall and the adjacent mastoid are removed simultaneously to gain direct access into the mastoid antrum (Fig. 4). This bone may be removed with the electrically driven burr, as utilized by Lempert (6), or with the gouge and mallet. With this direct approach into the mastoid antrum (Fig. 5), the operator is always oriented in relation to important internal landmarks; the rim of the annulus tympanicus identifies the depth of the vertical course of the facial nerve; and, immediately upon entering the antrum, the operator can identify the external surface of the horizontal semicircular canal. Thus oriented, the operator exenterates all disease in the mastoid. The cortex is removed from the mastoid tip only to the extent which is necessary to uncover any tip cells or to bring the level of the inferior surface of the antrum down to the level of the

inferior surface of the external auditory canal. Trautman's angle is explored, and all disease external to the superior semicircular canal removed. A sclerotic mastoid tip is not disturbed. In the usual chronic disease of the ear, this exteriorization and exploration of the antrum and periantral region constitute the limit of the mastoidectomy. If the medial surface of the antrum is found to be lined with the matrix of a cholesteatoma, this squamous epithelium is not disturbed.

This direct approach into the mastoid antrum discards the long taught technique of performing a simple mastoidectomy before beginning the removal of the bony wall of the auditory canal. It thereby minimizes the danger of injury to the sigmoid sinus. Further, with the immediate identification of the horizontal canal and antrum, the inexperienced operator is less likely to create a false antrum below the canal or transect the vertical course of the facial nerve. Figure 5, the drawing of specimen 2, illustrates the high position of the mastoid antrum relative to the auditory canal.

Tympanectomy. The dissection of the tympanic cavity is divided into the dissection of the epitympanum, dissection of the hypotympanum, and the dissection of the tympanum proper, including the eustachian tube orifice. The dissection of the epitympanum is begun with the removal of its external wall. This simultaneous removal of the external wall of the epitympanum and thinning of the bridge will bring into view the incus and the head of the malleus. The incus or its remnants are removed at the earliest convenience. The external wall of the epitympanum is removed well anteriorly to exteriorize the anterior cul-de-sac of the epitympanum completely. The entire expanse of the bridge (the inner superior wall of the external auditory canal over the notch of Rivinus) is thus brought into view. The thinned arch of the bridge is removed with the Lempert rongeur (Fig. 6), the initial bite being taken well anteriorly to avoid injury to the facial nerve. The posterior buttress of the bridge (Stacke's spine) is left in position until the final stages of the operation to protect the footplate of the stapes and the facial nerve. The anterior buttress of the bridge and the remaining external wall of the

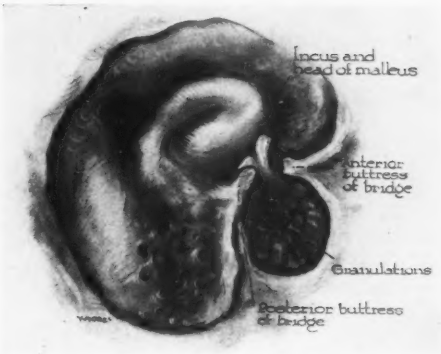

Fig. 6. The epitympanic dissection begins with the removal of the external wall of the attic and the narrowing of the bridge. Here, the arch of the bridge has been removed. The anterior buttress of the bridge is next removed to permit the epitympanic dissection. The posterior buttress of the bridge is left in position until the final stages of the operation to protect the peristapedial area.

attic is now removed anteriorly to the plane of the anterior limit of the anterior wall of the external auditory canal (Fig. 7). The malleus or its remnants are removed. The medial wall of the epitympanum is explored from behind, forward. With the face of a small mastoid curet directed medially, the mucous membrane is dissected off the ampulla of the horizontal semicircular canal, and this dissection is carried downward and forward off the ampulla to identify the cochleariform process of the tensor tympani muscle. From this point, the dissection is then carried downward and backward, and the entire intratympanic course of the facial nerve delineated (Fig. 7). The nerve, so identified, may be avoided. With the intratympanic course of the facial nerve identified, all remaining disease in the epitympanum is exenterated.

Dissection of the hypotympanum. Dissection of the hypotympanum requires an additional incision, the removal of the annulus and the infra-annular mass, and the exenteration of the hypotympanic disease. With an angulated canal knife, an incision is made through the skin and periosteum, 5 millimeters external and parallel to the annulus tympanicus, in a manner similar to the Lempert (8) incision for the tympanosympathectomy. This 5 millimeters of epithelium and the remaining fibro-

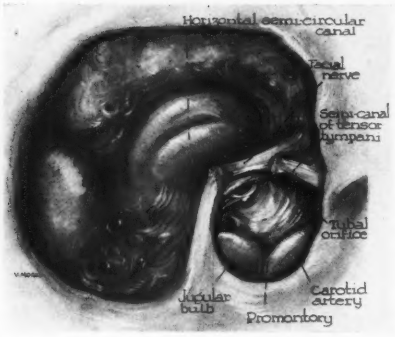

Fig. 7. The completed radical mastoidectomy reveals the exenteration of all disease in the tympanic and mastoid cavity, with delineation of all the internal landmarks of the middle ear and mastoid.

cartilaginous ring of the annulus tympanicus are then dissected free to permit direct visualization of the annulus. The remaining inner cutaneous lining of the auditory canal, the free fibrocartilaginous ring of the annulus, the remnants of the tympanic membrane, and the free excess of granulations are then removed from the tympanic cavity. Before the detailed dissection is continued, a pledget of epinephrine is placed in the tympanic cavity to secure hemostasis; this procedure may be repeated from time to time to permit accurate visualization. When a dry field has been obtained, the inferior portion of the annulus tympanicus and the underlying infra-annular mass of bone (Fig. 1) are removed to the level of the floor of the hypotympanum with the large polishing burr. The polishing burr is preferred, as it is easily controlled and is less likely to engage any fragments of tissue. The burr should rotate in an anterior direction (clockwise in the right ear and counterclockwise in the left ear) to avoid running in the direction of the stapes. With the hypotympanum thus exteriorized, the mucous membrane and granulation tissue is dissected from below, upward, off the medial wall of the hypotympanum, delineating the jugular bulb posteriorly and the carotid artery anteriorly (Fig. 2). The potential routes of cellular extension are explored, and infection removed. The end result is a wide open hypotympanum with all accessible disease removed.

Dissection of the tympanic cavity and eustachian tube. The dissection of the tympanum proper is begun with the removal of infected tissue from the promontory. This is carried forward to exenterate the disease in the eustachian tube orifice and, finally, posteriorly to the peristapedial area.

The exenteration of the tympanic disease is begun at the cochleariform process. As the dissection is carried anterior to the cochleariform process, the mucous membrane and granulation tissue are elevated from the external and inferior surfaces of the semicanal of the tensor tympani muscle (Fig. 7). The dissection is carried downward, off the anterior surface of the promontory and then anteriorly, well into the orifice of the eustachian tube. Then, as the dissection is continued upward from the hypotympanum, the mucous membrane, granulations, and the tympanic plexus are elevated from the promontory of the cochlea and, again, the dissection carried well forward into the orifice of the eustachian tube. The resultant aggregation of tissue in the orifice of the eustachian tube is grasped with the aural biting forceps and avulsed from the depth of the tubal orifice. All accessible disease is then removed from the eustachian tube orifice with a small mastoid curet and aural biting forceps. The dissection is carried well into the eustachian tube; however, no attempt is made to produce a stenosis at the isthmus. Nor is an unaffected tensor tympani muscle ever disturbed.

Throughout the operation, the peristapedial area has been protected by a relatively high facial ridge and by the posterior buttress of the bridge (Stacke's spine). The facial ridge (posterior bony wall of the external auditory canal) is now lowered to the external surface of the horizontal semicircular canal (Fig. 7). In the performance of this maneuver of lowering the facial ridge, the burr should rotate in a posterior direction (counterclockwise in the right ear; clockwise in the left ear) so that the burr will never run into the middle ear to produce irreparable damage. The lowering of the facial ridge will thin the posterior buttress of the bridge from without, inward, to the point of spontaneous fracture. The final removal of the posterior buttress exposes the peristapedial

area. Infected granulation tissue around the stapes and the oval window is removed, the dissection always being from posteriorly, anteriorly, in the long axis of the footplate of the stapes to obtain maximum utilization of the fixing or guy-wire effect of the stapedius muscle (Fig. 7). Any infected granulation tissue is removed from area of round window.

This minute dissection of the peristapedial area is carried out only when this area is involved with infected granulation tissue. If the peristapedial area is lined with a relatively healthy mucous membrane or with the lining matrix of a cholesteatoma, this thin epithelium is always preserved. The preservation of such epithelium will result in minimum postoperative scarring in the peristapedial area and maximum postoperative mobility of the footplate of the stapes. As Meltzer and Baron have pointed out, the preservation of such epithelium will result in maximal postoperative preservation of hearing.

Summary of radical mastoid technique. The end result of the tympanomastoid dissection should be a perfectly dry cavity with no remaining granulation tissue. Posteriorly, the mastoid antrum and air cells have been explored and all disease exenterated. The cortex of the mastoid tip has been lowered to the level of the floor of the external auditory canal or to the inferior limit of the residual mastoid tip cells. The sclerotic portion of the mastoid tip has not been disturbed. Superiorly, the overhanging mastoid cortex has been removed to the level of the tegmen of the middle cranial fossa. Anteriorly, the external wall of the attic and the bridge have been removed to the anterior limit of the anterior cul-de-sac of the epitympanum. Inferiorly, the floor of the bony wall of the external auditory canal (the infra-annular mass) is lowered to the depth of the hypotympanic cells. Medially, the facial ridge (the posterior bony wall of the external auditory canal) has been lowered to the level of the external surface of the horizontal semicircular canal. With the tympanic cavity thus exteriorized, all granulation tissue and disease have been removed from the tympanic cavity and eustachian tube orifice. The exteriorized mastoid cavity and middle ear will then receive a primary skin graft.

Fig. 8. The entire radical mastoid cavity has been lined with the primary skin graft. The skin flap is turned over the margin of the conchal cartilage. The upper two-thirds of the vertical incision is closed with two vertical mattress sutures. The skin graft is sutured to the anterior margin of the lower one-third of the vertical incision. The skin graft and rayon are held in position with synthetic sponge packing.

PRIMARY SKIN GRAFT

The meticulous postoperative care of the radical mastoidectomy is as essential to a good result as is the accurate and thorough exenteration of disease. The goal of this postoperative care is to secure a healed radical mastoid cavity which resembles in shape the postoperative bony cavity and is covered with the thinnest possible epithelium, particularly in the region of the oval and round windows. The primary skin graft is an aid in attaining this goal, through more rapid healing, reducing the possibility of annoying granulation tissue and stenosis of the cavity, and, in reducing the postoperative cicatrization in the peristapedial area.

The skin graft is taken prior to the mastoidectomy to avoid contamination of the donor site and the necessity of a second sterile operative setup. During mastoidectomy, the skin is preserved in normal saline and, at completion of the mastoidectomy, strips of skin are cut in a pattern to dress the operative cavity.

Instruments. The instruments for obtaining a good otological skin graft consist of the Weck razor and an appropriately shaped skin traction block. The Weck razor is preferred to any other type of dermatome or skin graft knife because of the sharp, expendable blades. Skin traction blocks are notched to the width of the

blade to provide an elevated flat donor site with depression of the adjacent skin.

Technique. After being surgically prepared, the donor site is thoroughly greased with sterile vaseline. The right skin traction block is held in fixed position by the assistant; the left skin traction block is held in the operator's left hand with the blade flat against the donor site. The operator follows the progress of the left skin traction block with gentle to and fro movements, adjusting the thickness of the skin to his individual preference. Eliminating all cumbersome equipment, this simple technique provides a thoroughly adequate otological skin graft.

Application. When the mastoidectomy is nearing completion, the surgical nurse spreads the skin on wet surgical rayon, with the cut surface up. The skin and the rayon are then cut to a pattern to fit the mastoid cavity. The rayon backing makes the skin more manageable. It is my practice to cut three strips (A, B, and C) to be applied to the cavity. Section A covers the medial wall of the tympanum, the hypotympanum, and the denuded auditory canal. Section B covers the facial ridge, the medial wall of the antrum, and the sigmoid sinus plate. Section C covers the epitympanum, the tegmen, the temporal muscle, and the lower one-third of the vertical incision. As each section is placed over its individual area, it is anchored in position with a small pledget of synthetic sponge and the long free end of the rayon is brought out of the auditory canal to provide further fixation. The thinnest available portion of the skin is selected to line the medial wall of the tympanum. Its free border is placed adjacent to, but never over, the oval and round window. This free border of skin provides an island from which the thinnest possible layer of epithelium can grow to cover the oval and round windows. The incision is closed as illustrated in Figure 8.

Postoperative care. The synthetic sponge and rayon are removed at the end of the first postoperative week. The cavity may then be treated as the surgeon desires; I prefer repacking at weekly intervals for 3 weeks. One-half inch gauze, soaked in furacin, is used for packing. The bacteriostatic action of the furacin will usually permit the packing to remain in position for 7 days. The epithelial debris may be wiped away at the end of the second, third, and fourth postoperative weeks. If the cavity has been well lined with skin, epithelization will be nearly complete at the end of the fourth postoperative week. Thereafter, one may adopt dusting powder, gentian violet, or drops until healing is complete.

COMMENT

The success of the radical mastoidectomy is dependent upon the minutely accurate exenteration of the tympanic and mastoid disease and upon meticulous postoperative care of the radical mastoid cavity. The completed radical mastoidectomy should consist of the exteriorization of all pockets of infection and the exenteration of all accessible disease. The postoperative care of the radical mastoidectomy is greatly facilitated by the primary skin graft.

SUMMARY

1. Sound anatomical knowledge has been the basis for the present renaissance in otological surgery.

2. The minute anatomy of the hypotympanum, the eustachian tube and tympanic cavity have been reviewed in reference to the radical mastoidectomy.

3. The technique of the radical mastoidectomy has been outlined.

4. The primary skin graft is advocated to facilitate complete postoperative healing of the radical mastoid cavity.

5. The technique of skin grafting is outlined.

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THE SUCTION SOCKET FOR ABOVE-KNEE AMPUTEES

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THE suction socket prosthesis for above-knee amputation eliminates pelvic band and shoulder harness. The special construction and fitting cause it to be held on to the stump by a moderate amount of suction. The authors have had an opportunity to observe the fitting and use of more than 60 suction socket prostheses during the training and experimental programs of The Committee on Artificial Limbs of the National Research Council and Veterans Administration, plus observations on private patients.

Observations indicate that the suction socket compared to the conventional leg is less cumbersome, allows a greater range of mobility, feels more like an integral part of the patient, and offers less interference with clothing.

In 1863 Parmelee of New York obtained the first known patent on the suction socket. Subsequent patents were issued to Beacock and Sparham of Ontario, Canada, in 1885; to Toles of Stockton, California, in 1911; and to Underwood of Birmingham, England, in 1926.

Following the first World War, several groups in England employed the suction socket with variable results. However, use of the suction socket in England has been dormant for a number of years but has been revived recently. In Germany the suction socket was made and used to some extent following World War I, but it was not popularized until a satisfactory valve was devised in 1932. Since that time, and especially during the recent war, it has been used for many above-knee amputations.

The Surgeon General of the United States Army sent a commission to Europe in 1946 to study the various aspects of amputations and prostheses. The recommendations of this commission[1] were acted upon by the Advisory Commission on Artificial Limbs of the National Research Council, which instituted in this country a program, in collaboration with the Veterans Administration, to investigate the use and development of the suction socket.

A national suction socket training program for training of surgeons and limb fitters was implemented by the Committee on Artificial Limbs of the National Research Council and the Veterans Administration. The initial school was held at the University of California, Berkeley, California, November 19, 20, 21, 1947, under the direction of Professor Howard D. Eberhard and Doctor Verne T. Inman. Subsequently, schools were held at various centers throughout the country under the auspices of the Veterans Administration and the Orthopedic Appliance and Limb Manufacturers Association. Completion of the specified work offered in these schools resulted in the certification by the Veterans Administration and the Orthopedic Appliance and Limb Manufacturers Association of surgeons as qualified under the Veterans Administration Experimental Suction Socket Program, and certification of limb fitters for the manufacturing and fitting of suction sockets under the same program.

The Veterans Administration and various certified limb fitters are now conducting a continuing experimental suction socket program. Under it carefully selected and supervised patients at several centers have been, and are being, furnished suction sockets. These patients are studied and followed carefully.

From the Orthopaedic Service, U. S. Veterans Hospital (Wadsworth General Hospital), Los Angeles, California, and U. S. Veterans Administration, Regional Office, Prosthetic Division, Los Angeles, California.

[1]The Commission was composed of the following:
Colonel Leonard T. Peterson, MC, Chief of Amputation and Prostheses Unit, Surgeon General's Office.
Doctor Paul E. Klopsteg, Chairman, Committee on Prosthetic Devices, National Research Council.
Lt. Colonel Rufus Alldredge, MC, Chief of Amputation Section, England General Hospital, Atlantic City, New Jersey.
Mr. Edmond M. Wagner, Executive Assistant, Committee on Prosthetic Devices, National Research Council.
Lt. Colonel Robert J. F. Lewis, Ordnance, Amputation and Prostheses Unit, Surgeon General's Office.
S/Sgt. John Paul Gavell, Recorder.

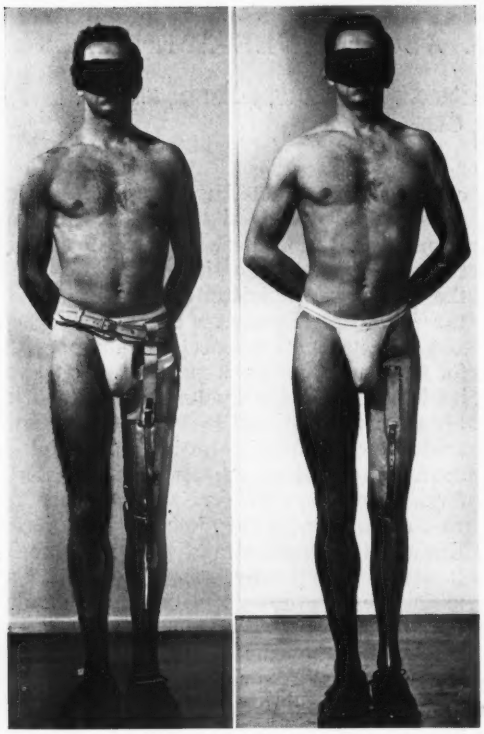

Fig. 1. a, left. Conventional type prosthesis with pelvic band. b, Same patient with suction socket prosthesis.

As a result of this program, some alterations of the suction socket have already been found advisable and others are being studied.

The characteristic features of the suction socket are:

1. Pelvic bands and shoulder harness are eliminated (Fig. 1).

2. The muscles of the stump control all movements.

3. The socket is held on by a moderate negative pressure, which requires an accurate and snug fit, but without undue pressure.

4. Stump socks are eliminated

5. Body weight is taken mainly on the ischial tuberosity. Some side bearing appears to be advantageous. In a few instances partial end bearing is tolerated.

6. The socket is applied by using a thin sock on the stump. This is pulled off and out through the valve opening at the distal end which pulls the stump into the socket. Body weight is then applied and the valve is screwed in, and the socket thus sealed.

Instruction in proper walking, muscle control, and posture are important to eliminate or reduce limp, unsightly gait, and lordosis.

The indication for a suction socket leg is a good thigh stump. The minimal length of stump is considered to be 4½ to 5 inches measured from the adductor tubercle to bone end. Shorter stumps require a pelvic band or shoulder strap.

The main contraindications are:

1. Large scars which are either painful or adherent over a prominent end. Extensive scars which are located at upper end of socket may cause loss of suction. These conditions however can be corrected surgically.

2. Osteomyelitis, unless it has been definitely arrested.

3. Large tender bony spurs. These, however, can be eliminated surgically.

4. Extensive skin disease. A dermatologist, however, can correct many of these conditions.

5. Capillary fragility and purpuric conditions, characterized by persons who bruise easily have been considered as contraindications but recently patients have been fitted successfully.

6. Unco-operative or mentally deficient patients.

Peripheral vascular disease has been considered a contraindication, but a few cases of Buerger's disease in younger individuals have been successfully fitted.

Bilateral above-knee amputees have been fitted satisfactorily with suction sockets, although one in the authors' series has not been successful as the patient is unable to put on the prostheses without aid.

The construction of the socket is from precut patterns. Willow wood is considered to be the most adaptable material for making the socket, as it can be reshaped easily to changing size of the stump. The socket can be made smaller by the addition of a liner, or enlarged by cutting out. Plastic material should not be used for the initial construction, but may be used later when the person becomes expert with the suction socket and the stump has stabilized in size.

Fig. 2. Top view of suction socket prosthesis; *a*, ischial seat; *b*, gluteal channel; *c*, protuberance behind trochanter; *d*, adductor channel; *e*, valve opening.

Fig. 3. Side view of suction socket prosthesis; *a*, ischial seat; *b*, gluteal channel; *c*, protuberance behind trochanter; *d*, adductor channel; *e*, valve opening.

The following points of construction are emphasized (Figs. 2 and 3):

1. Medially a channel is cut out for the adductor muscles. The height is determined by individual variations and comfort, being approximately the same as the ischial seat.

2. Anteriorly, the fit is snug but not tight enough to cause compression on the femoral vessels. If too high it causes pressure in sitting. The upper and inner portion of the socket is often slightly undercut approximately ½ inch below the top with a long taper in order to hold suction.

3. Laterally, the socket is made higher, almost to the tip of the trochanter. If too high it tends to obstruct abduction. A protuberance is left immediately in back of the trochanter which is of great benefit in assisting with rotation and stability.

4. Posteriorly, a cut-out is made for the gluteus maximus. The ischial seat is of utmost importance and specific details, such as height, size, shape, and incline, must be carefully individualized.

5. One or 2 inches of free space in the socket at the end of the stump is desirable to allow for installation of the valve.

6. A screw-type automatic expulsion valve, allowing a small exchange of air, is now generally used. It is placed at the distal end of the socket and preferably not in contact with the skin. It should be in an accessible place for the patient to remove the thin sock in pulling the stump into the socket, as well as for manual control of the valve. A negative pressure of 1½ pounds per square inch during the swing phase of walking and ½ pound of positive pressure during the stance phase are considered sufficient. Greater pressures are in general undesirable and can be regulated by valve corrections.

7. Several different types of finish have been used but in general cellulose acetate has been most satisfactory.

Mistakes in construction which must be avoided are:

1. An ischial seat which is either too high or too deep, or prolonged too far medially causing adductor constriction and pressure on ramus. An ischial seat having too much undercut causing stretching of skin over its sharp border and pressure on sitting.

2. The gluteal channel cut too narrow causing undue pressure.

3. Too tight a fit, anteriorly, causing pressure on femoral vessels with subsequent edema of stump, and interference with flexion.

4. A socket cut too high or narrow medially causing adductor pressure.

5. A socket cut too high laterally limiting abduction.

6. Too much vacuum, or negative pressure.

Complications, if present, generally arise because of improper selection of cases and inadequate attention to details of construction. Pressure spots can generally be relieved by minor reshapings. Edema, which is not an uncommon complication, is usually due to either too much negative pressure or excessive pressure over the femoral vessels anteriorly or an extremely tight fit of the stump. Either can, as a rule, be corrected easily. Excessive perspiration may occur. A small amount of silica gel placed in the bottom of the socket usually will control this.

Ischial irritation has been the most troublesome feature of the suction socket. Careful fitting and reshaping as well as perseverance on the part of the patient are necessary to overcome this.

It has been noted that during the early stages of wearing a suction socket shrinkage of the stump is apt to occur. This is frequently followed by hypertrophy. One wearer has increased his stump circumference 5½ inches, and is wearing his seventh socket. Hypertrophy apparently occurs in the muscular tissues from their active use in control of the prosthesis.

Success of the suction socket depends largely on the whole-hearted co-operation of the surgeon, patient, and limb fitter, with frequent consultations during fitting, and as needed whenever difficulties arise.

SUMMARY AND CONCLUSIONS

The suction socket prosthesis has by accumulated evidence, both in this country and abroad, proved to be most satisfactory in the majority of selected cases of above-knee amputation. The most important features are the following:

1. Elimination of pelvic bands and shoulder harness.

2. Easier control of prosthesis and greater ranges of motion.

3. A feeling that the prosthesis is an integral part of the wearer.

4. Less interference with clothing.

THE EFFECT OF MODERATE DEGREES OF DICUMAROL-INDUCED HYPOPROTHROMBINEMIA ON EXPERIMENTAL INTRAVASCULAR THROMBOSIS

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THE drug dicumarol is being used extensively in attempts to prevent or inhibit intravascular thrombosis. Surgeons have employed it as a prophylactic measure against postoperative thrombosis and embolism, as a therapeutic agent in established deep phlebitis of the lower extremities and more rarely as an adjunct in certain operations on blood vessels. Internists have been particularly interested in its possible effect on the incidence of thromboembolic complications in acute myocardial infarction.

There is no doubt that dicumarol exerts a powerful effect on the coagulation mechanism if it is given in sufficient quantities to produce a marked depression of the prothrombin level. In an early experimental study, Dale and Jaques demonstrated a reduced incidence of thrombosis in the traumatized veins of dicumarolized dogs. However, it is little wonder that clotting was inhibited because so much dicumarol was administered (10 mgm. per kilogram) that the prothrombin time was above 100 seconds at the time of the test in all of the animals, and it frequently exceeded 200 seconds, indicating prothrombin percentages well below 1 per cent.

In like manner, in the study of Richards and Cortell, extreme degrees of hypoprothrombinemia were produced in a small series of dogs. The prothrombin times of their 4 dogs varied from 171 to 491 seconds; the injection of monolate solution into veins produced less thrombosis than in the controls, but all of the animals subsequently died of hemorrhage.

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Thill, Stafford, Spooner and, Meyer produced experimental thrombosis by injecting 0.25 cubic centimeter of monolate solution into the radial veins of dogs. Fifteen animals were given a single dose of dicumarol, 5 milligrams per kilogram and 2 days later, the sclerosing solution was injected. At this time, the prothrombin time varied from 5 to 46.5 seconds (median 18.5 seconds). About a week later, the veins were removed for histologic study. Only 2 veins (6.6 per cent) showed definite thrombosis as compared with an incidence of 50 per cent thrombosis in the controls. No excessive bleeding was encountered at the operation and no postoperative hemorrhage was noted. Hence, they were able to conclude that a definite reduction in the incidence of thrombus formation was noted in dogs previously treated with dicumarol in a dosage equivalent to a therapeutic and safe quantity commonly administered to human beings. Their data could be assumed to provide at least a partial answer to the question which is posed by the title to this communication.

Kieswetter and Shumacker carried out a study of the comparative efficacy of heparin and dicumarol in the prevention of experimental arterial and venous thrombosis. The arteries were traumatized by a deliberately careless suture of incisions into the vessels; the veins were injected with sodium morrhuate. In their control group of 9 animals, thrombosis was present in 92.9 per cent of the femoral arteries, 66.7 per cent of the carotid arteries, and 85.2 per cent of the veins. With heparin administration, they reduced these percentages to 6.7 per cent, 9.5 per cent, and 56.3 per cent respectively. In 10 animals treated with dicumarol before and after operation (prothrombin levels kept below 30 per

Fig. 1. Veins removed from 2 animals 2 days after trauma. The radial veins (on left) are thrombosed, the long saphenous veins (middle) are thrombosed, and the short saphenous veins (right) are free of thrombosis, although it is obvious that the intima has been damaged.

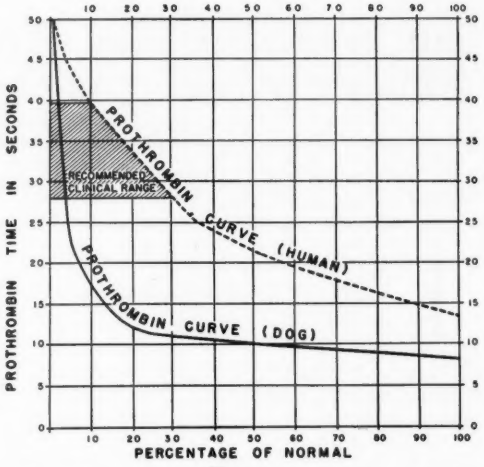

Fig. 2. Empiric curves used to convert Quick prothrombin time values to percentage values.

cent of normal), thrombosis occurred in 50 per cent of the femoral arteries, 15.8 per cent of the carotid arteries, and 41.4 per cent of the veins.

This inhibition of thrombosis had its price in the form of hemorrhagic complications, however. Of 35 animals treated with heparin, 25 or 71.4 per cent had subcutaneous hemorrhage; there were 19 large hematomas. Nine animals (25 per cent) actually died of hemorrhage. Of 25 dogs treated with dicumarol, 11 or 44 per cent bled subcutaneously. There were 5 large hematomas and 3 deaths from hemorrhage. It is doubtful if a clinical surgeon would be willing to contend with such a complication and mortality rate in order to obtain the possible beneficial anticoagulant effect of either drug.

Most of those who have recommended the use of dicumarol clinically have indicated that they are satisfied with very conservative doses of the drug, so that hemorrhagic complications are minimized. Peters, Guyther, and Brambel tried to keep the prothrombin level in their 50 cases of coronary occlusion between 35 and 50 per cent of normal. Glueck, Strauss, Pearson, and McGuire preferred a level between 20 and 30 per cent. The American Heart Association is carrying out a controlled clinical study of the use of dicumarol in acute myocardial infarction. The instructions to co-operating clinics state that the administration of dicumarol should be discontinued if the prothrombin time goes to 35 seconds. This would represent about 20 per cent of normal. Preliminary reports from this study (exhibit at American Medical Association, 1948) indicate that the drug has a valuable effect in preventing thromboembolic complications. However, in this connection it must be mentioned that at least one clinician (2) prefers that his patients with acute coronary occlusion have a normal prothrombin level, and he administers vitamin K therapy to this end.

The present study was undertaken to study the effect on experimental intravascular thrombosis if dicumarol is administered so as to produce an effect comparable to that commonly sought in human cases, i.e., so that the prothrombin level is in the range of 10 to 30 per cent of normal.

It was elected to use traumatized veins as the experimental lesion to produce thrombosis. The technique was identical with that used by Murray, Jaques, Perrett, and Best in their investigation of the effect of heparin. The dogs were anesthetized with intravenous nembutal. A surgical incision was made parallel to, but a short distance away from, the vein to be tested. A round, curved needle bearing a heavy silk thread was passed into the lumen of the vein for a distance of 2½ centimeters and then out again. The length of vessel con-

TABLE I.—RESULTS IN GROUP I

Dog No.	Daily* prothrombin times in seconds			Daily prothrombin percentages			Daily coagulation times in minutes			Thrombosis in veins			Hematomas
										Radial	Long saph.	Short saph.	
40	10.5	10	14	40	50	14	9	8	7	+	+	+	0
41	12	17.5	17.5	19	4.5	4.5	9.5	7.5	9.5	+	+	+	0
43	9.5	25	17	75	3	5	9.5	14	7.5	+	−	−	0
44	11	10.5	9.5	25	40	75	4.5	9	7.5	+	+	+	0
46	15	9.5	7.5	6.5	75	100	5.5	3.5	9.5	+	+	−	0
49	12	9.5	10	19	75	50	9	3.5	6.5	+	+	+	0
52	12.5	8.5	8.5	18	100	100	9	9.5	6	−	+	+	0
53	12	13	8.5	19	15	100	5.5	8.5	9.5	+	+	+	0
55	9.5	9	8	75	82	100	6.5	4.5	8	−	+	−	0
36	12	26.5	12.5	19	3	18	10	12	8	−	+	−	0
Total: 10 dogs, 30 veins.							Total thrombosis:			7	9	6	0
												Total 22 (70%)	

*Day of trauma and next 2 days.

TABLE II.—RESULTS IN GROUP II

Dog No.	Daily prothrombin times in seconds			Daily prothrombin percentages			Daily coagulation times in minutes			Thrombosis in veins			Hematomas
										Radial	Long saph.	Short saph.	
6	22	29	24	5	3.5	4	10	12	8	+	+	+	0
8	23.5	12.5	18	3	19	4.5	13	15	22	+	+	+	0
11	27	24	32	4	4	3	18	24	18	+	+	−	+
31	25	41	23	3	2	3	14.5	18	18.5	+	−	+	+
32	21	21	15	3	3	6.5	14.5	14	5	+	+	−	+
33	23	21.5	23.5	3	3	3	10	9	12.5	−	+	+	0
35	19	16.5	22.5	4	5.5	3	3	13.5	9.5	+	+	−	0
36	16.5	18	10	5.5	4.5	50	5	11.5	10.5	−	+	−	0
38	16	25.5	11	6	3	25	14	10.5	13.5	−	+	−	0
50	16.5	14.5	8.5	5.5	5.5	100	9	8	7	+	+	+	0
Total: 10 dogs, 30 veins.							Total thrombosis:			7	9	5	3 (30%)
												Total 21 (70%)	

taining the suture was then crushed with an artery forceps in three planes. Reasonably uniform trauma to the intima was assumed since the same clamp was used throughout the study and it was always clamped to the first notch. After the crushing, the silk was withdrawn from the vein. Bleeding from the holes made by the needle was negligible. Two days later, the incisions were opened and the veins were inspected for evidence of thrombosis. Patency was determined by cutting across the vein proximal to the crushed area, after which the entire segment was resected and opened (Fig. 1).

Six veins on each animal were used. These were the radial, long, and short saphenous veins on the two sides. For the control series, the three veins on the animals' right were traumatized. This series comprised 41 animals or a total of 123 veins. The radial vein was found to be thrombosed 29 times, the long saphenous 37 times, and the short saphenous 31 times. Thus, 97 out of 123 veins were thrombosed, an incidence of 78.8 per cent.

Numerous determinations of prothrombin levels as well as coagulation times were carried out before and during dicumarol administra-

TABLE III.—RESULTS IN GROUP III

Dog No.	Daily prothrombin times in seconds			Daily prothrombin percentages			Daily coagulation times in minutes			Thrombosis in veins			Hematomas
										Radial	Long saph.	Short saph.	
7	36.5	47	19	2.5	1.5	4	28	29	18	+	−	+	2
99	32	44	27	3	2	4	22	33	32	−	+	−	1
12	30	38	47	2.5	2.5	2	14.5	16.5	20	−	−	−	1
13	32	45	22	3	2	5	20.5	22.5	17	−	−	−	1
14	38	39	39	2.5	2.5	2.5	16	11	22.5	−	−	−	1
15*	38	95	—	2.5	0.5	—	22	24	—	−	−	−	1
16	32	38	28	2.5	2.5	3	16.5	16	19	−	−	−	1
25	36	37	18.5	2.5	2.5	9.5	12	14	12	−	−	+	2
26*	32	79	−	3	0.5	−	15	20	−	−	−	−	1
27	33	40	61	3	2	1	∞	19	25	−	−	−	2
Total: 10 dogs, 30 veins.							Total thrombosis			1	1	2	13 (100%)
													Total: 4 (13.3%)

*Animal expired of hemorrhage.

TABLE IV.—RESULTS IN GROUP IV

Dog No.	Daily prothrombin times in seconds			Daily prothrombin percentages			Daily coagulation times in minutes			Thrombosis in veins			Hematomas
										Radial	Long saph.	Short saph.	
1	69	104	80	<1	<1	<1	7	12	19	−	−	−	3
2	110	174	169	<1	<1	<1	8	23	40	−	−	−	3
3	144	105	80	<1	<1	<1	13	13	25	−	−	−	3
4	105	115	72	<1	<1	<1	13	11	14	−	−	−	3
5	77	100	38	<1	<1	2.5	24	40	12	−	+	−	1
10*	50	110	−	1.5	<1	−	29	−	−	−	+	−	3
Total: 6 dogs, 18 veins							Total thrombosis			0	2	0	16 (100%)
													Total: 2 (11.1%)

*Animal expired of hemorrhage.

tion. The prothrombin method was that of Quick, using a commercial preparation of thromboplastin. For the conversion of time values to percentage values, empiric curves were constructed from the prothrombin time values obtained from testing known dilutions of dog plasma (Fig. 2). Several batches of thromboplastin gave normal prothrombin time values varying from 7.5 seconds to 10.5 seconds. The same thromboplastins gave values on human plasma varying from 13 seconds to 17 seconds. The coagulation time of the blood was determined by a modification of the Lee and White method. Several cubic centimeters of blood were placed in 3 Wassermann tubes. One of the tubes was inverted at 30 second intervals until the clot retained its position in the bottom of the tube, after which the second tube and, finally, the third tube were inverted until clotting was seen to take place.

Following the control study, dicumarol was administered by mouth (mixed in meat) until the desired prothrombin level was obtained, after which the three veins on the animal's left were traumatized and examined 2 days later. An effort was made to keep the prothrombin level stable during the experimental period by feeding small maintenance doses of dicumarol.

A protocol of a typical animal experiment follows:

Protocol. Dog No. 8. Weight 12 kilograms.

November 24, 1947. Prothrombin time 9.5 seconds (60 per cent). Coagulation time, 5 minutes. Radial, long and short saphenous veins on right traumatized.

November 26. Prothrombin time 9 seconds (80 per cent). Coagulation time 9 minutes. Investigation of previously traumatized veins revealed thrombosis of the radial and short saphenous veins, patency of the long saphenous vein.

November 28. Dicumarol 50 milligrams.

November 29. Dicumarol 25 milligrams.

November 30. Dicumarol 12.5 milligrams.

December 1. Prothrombin time 23.5 seconds (3 per cent). Coagulation time 13 minutes. Three veins on left traumatized. Dicumarol 12.5 milligrams.

December 2. Prothrombin time 12.5 seconds (19 per cent). Coagulation time 15 minutes.

December 3. Prothrombin time 18 seconds (4.5 per cent). Coagulation time 22 minutes. Examination of traumatized veins on left showed thrombosis in all three. No ecchymosis nor hematoma present. Animal discarded.

The experiment was completed on 36 dicumarolized dogs. These animals could be divided into four groups: Group I (10 animals) with veins traumatized when the prothrombin time was in the range of 9 to 15 seconds (57 per cent down to 6.5 per cent); Group II (10 animals) with the veins traumatized when the prothrombin time was between 16 and 28 seconds (from 6 per cent down to 3 per cent); Group III (10 animals) with a prothrombin time range of 28 to 39 seconds (3 per cent down to 2 per cent) and Group IV (6 animals), with prothrombin times above 40 seconds (percentage under 2 per cent). The significant data with regard to these four groups are shown in the corresponding tables (Tables I-IV). For purposes of brevity, the prothrombin values and the coagulation times are indicated for the 3 significant days of the experiment, namely: the day of trauma to veins, the intervening day, and the day of examination of veins for thrombosis.

COMMENT

In Table I, it will be noted that in this group of animals, a minimal dicumarol effect was produced. Nevertheless, in 7 of the 10 animals, the prothrombin percentage was below 30 on the day the veins were traumatized. Sometimes the prothrombin level was higher on the following days, sometimes it was lower. The coagulation times were within normal limits. Seventy per cent of the veins were thrombosed, only slightly below the 78.8 per cent found in the controls.

TABLE V.—SUMMARY OF RESULTS

Group No.	Prothrombin time range seconds	Prothrombin percentage range per cent	Number of veins	Per cent thrombosis	Per cent animals with hematoma
Controls	7.5– 9	100	123	78.8	0
I	9 –15	6–75	30	70	0
II	16 –28	3–6	30	70	30
III	28 –39	2–3	30	13.3	100 (2 fatal)
IV	Over 40	<2	18	11.1	100 (1 fatal)

The animals in Group II were dicumarolized to a degree commonly thought to be well within the therapeutic range (prothrombin percentages between 3 and 6 per cent). All of the animals showed one or more coagulation times slightly above normal. Hematomas were present in 3 of the animals. Nevertheless, the incidence of thrombosis was still high (70 per cent).

In the third group of animals (Table III), we find that the desired therapeutic effect of dicumarol has been obtained, since thrombosis occurred in only 4 out of 30 veins (13.3 per cent). However, to produce this effect, it was necessary to depress the prothrombin to a level below 3 per cent of normal. The coagulation time was frequently 3 to 5 times the normal value. Hematomas were present in all of the animals, and 2 died of hemorrhage during the experiment. Similar results are seen in the fourth group (Table IV) in which there were extremely low prothrombin levels (under 2 per cent).

A tabular summary of the results which were obtained in the control group and in the four groups which were treated in Table V may be seen.

CONCLUSIONS

Under the conditions of this experiment, moderate degrees of dicumarol-induced hypoprothrombinemia did not significantly reduce the incidence of thrombosis. At prothrombin levels below 3 per cent, it was found that there was marked inhibition of thrombosis and also an important increase in hemorrhagic complications.

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PAPILLOMA OF LACTEAL DUCT

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THE purpose of this paper is to present study and follow-up data on 87 cases of intraductal or intracystic papilloma seen at Scott and White Hospital during the period 1921 to 1946, inclusive. Follow-up reports by questionnaire method have been obtained for 77 (88.5 per cent) of these cases. Of those patients seen prior to 1943, representing a 5 year survival group, 84.0 per cent have responded to our inquiry.

The condition of papilloma of lacteal duct refers to a tumor, rarely more than 2 to 3 centimeters in diameter and often microscopic is size, located most often within the central zone of the breast. It is essentially a complex papillary mass projecting into the distended lumen of the duct. The papillary mass is made up of branching, quite vascular stromal bands coated by normal duct epithelium and usually attached at only one point to the wall of the duct. Often there is found an associated widespread hyperplasia of ductal epithelium.

In the present series, study of the case histories, in each case, with the recorded preoperative examination and opinion of the surgeon has given a unique opportunity to realize a practical point not emphasized hitherto in the literature; that is, that the papilloma is very often not the tumor which is felt at time of examination. As a rule, if a tumor is palpated, upon removal it is found to be an area of cystic mastitis; whereas, the intraductal papilloma or papillomas are often microscopic in size and are discovered only on careful study of the surgical specimen. Five exceptions to this rule were noted in this series. In these exceptional cases the papilloma was 1 to 2 centimeters in size, but a blood-filled cystic space had formed around it, causing the entire mass to be clinically palpable and surgically accessible.

Since bleeding at the nipple gives a clue to the probability of finding the chief disease process in one or more ducts, we have found that a modification of the usual methods of examination in the laboratory will give a much higher rate of positive findings. Instead of simply searching for the tumor by multiple cross sections of the breast, the examination follows the pattern of anatomical distribution of lacteal ducts in radiating fashion from the nipple. The breast is placed skin surface down and after the nipple is located as the center, many cuts down to skin level are made in the breast from the nipple to the periphery so that the entire duct system is exposed. Usually the involved duct or ducts will be prominent because of brown or bloody fluid present and quick but careful dissection will usually show the tumor in the duct. Quick frozen section can be made from the area with diagnosis resting upon a sound foundation of fact. The whole process takes only a few minutes longer than the older cross section method, is based upon anatomical distribution of the lacteal ducts, yields a much higher percentage of positive findings, and demonstrates the widespread distribution of disease. In our experience lacteal papilloma occurs chiefly in the area identified by the brown or bloody fluid along the path of involved ducts although other areas including the nipple itself must be carefully searched. The pathologist is always faced with the problem of how much papillary hyperplasia constitutes a papilloma and he must decide that for each case, for, in breasts of the type under consideration, papillary hyperplasia is very common. In most cases the differential diagnosis between the benign and malignant form of this is quite difficult. In line with the current accent on cytological study of fluids and smears we believe that detailed study of cells involved will help greatly. The work of Jackson and his associates is of great value in this field but we prefer excision biopsy. It is unusual to fail to find the pathological process if the radial dissection method is carried out.

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Diagnosis of this lesion rests squarely on microscopic evidence; however, certain clinical procedures are of definite aid. In addition to a careful history and inspection and palpation of the suspected area, it is agreed that an attempt to express secretion from the nipple should be made. If this is successful, a slide should be prepared and submitted to the pathologist for examination as to presence of red blood cells and, rarely, of tumor cells. Transillumination of the lesion is generally considered a help in diagnosis, for the blood-filled space which may surround the papilloma is opaque to light. Hicken recommended use of skiodan viscous as a contrast medium injected into the lacteal ducts to elicit the filling defect produced by these tumors. In regard to management of this lesion, it is emphasized by most observers that in the presence of cardinal symptoms of intraductal papilloma, either tumor or bleeding from the nipple, or both, surgery is required. Especially is this true since in approximately 50 per cent of cases of bleeding nipple a malignant lesion is revealed on exploration. The difference of opinion rests with the extent of the indicated surgery when an entirely benign lesion is encountered.

In separate reports based on series of 52 and 55 cases, respectively, Wakeley and Campbell urge simply local or wedge excision unless the lesion is multiple at time of surgery. Gray and Wood of the Mayo Clinic contended that bloody discharge is a serious sign and preferably merits simple mastectomy. However, no follow-up data are included in their study. Hicken emphasizes the work of Cheatle and Cutler, Adair, and others who have made serial sections of removed mammary glands. They had found papillomas to be multiple in a high percentage of cases, encountering as many as 150 separate and distinct papillomas scattered in one breast. Papillomas have been stated to be multiple in 15 to 37 per cent in 3 previously reported series. Here, 21.7 per cent were multiple, and in 2 (2.3 per cent) instances were bilateral. Also, Stowers, Hicken, and others have pointed out the coexistence of papilloma with papillary carcinoma, and the resultant necessity for assurance that all the disease entities in the particular breast be eradicated. Our series contains 3 cases of this latter category which will be mentioned in the follow-up study.

Briefly, arguments for a conservative local excision resolve themselves into (1) cosmetic and psychologic, (2) absence of demonstrated pathologic changes in the remaining breast tissue, and (3) lack of proof that the patient's risk is thus increased. Main arguments for simple mastectomy are (1) the 15 per cent "recurrence" rate following local excision, (2) the possibility of overlooked multiple papillomas with later malignant changes, and (3) overlooked papillary carcinoma in another portion of the same breast.

CLINICAL FEATURES

The clinical features noted in lacteal papilloma are summarized in the following paragraphs. These data conform closely to those in series reported by Geschickter and Grant and Wood.

Of the total of 87 histologically proved cases of intraductal papilloma, 81 patients (93 per cent) were married and 6 single at the time of admission. A family history of cancer was mentioned by 21 patients. One or more pregnancies were noted for 57 patients. The average age was 44 years, ranging between 26 and 67 years.

Twenty patients had records of previous breast surgery, more often on the opposite breast, and this was of varied type, including incision for "abscess," excision of lipomas or areas of cystic mastitis. The left breast was involved in 40 cases, the right in 36, and there was involvement of both breasts in 11 cases. The chief complaint upon admission concerned the breast in 81 cases. Since most patients had been referred, it is believed that this latter figure is probably abnormally high as compared to that which might be expected in routine office practice. Since these tumors are small and painless, in the absence of discharge, examination of the nipple area as a matter of routine becomes of importance for diagnosis.

Duration of symptoms was variable, averaging 10 months but ranging from 1 month in 14 cases to 20 years in 1 case, and long-time discharge, sometimes bloody in type, was not uncommon. Although all observers agree that sanguineous nipple discharge merits ex-

TABLE I.

Surgery	No. of cases Local excision	No. of cases Simple mastectomy
Discharge alone	5	21
Tumor alone	23	15
Tumor and discharge	11	11
Pain or tenderness	(15)	(13)
Retraction of nipple	(2)	(3)
Total	39	47

Note: Another patient, the 87th of the series, had radical mastectomy performed for extensive associated cystic mastitis of borderline histologic malignancy. She is in good health 12 years following surgery.

TABLE II.

	No. cases Local excision	No. cases Simple mastectomy
Not followed	5	5
Well 2–3 years	20	25
Well 5 years	14	17
Recurrence	2	0
Subsequent surgery	3	0
Per cent followed—88.5		

ploration, it bears re-emphasis that the finding is purely a symptom and, in roughly 50 per cent of cases, a benign lesion will be encountered.

All patients in this series had findings of either nipple discharge, tumor, or both (Table I). As pointed out earlier, the tumor palpated was usually not the intraductal papilloma but more often was an area of cystic disease. It is apparent upon dividing the cases into two groups depending on type of surgery performed that the tendency here at Scott and White Hospital during this period has been for the operator to remove the local tumor and, when the frozen section is reported benign, to close the wound. Conversely, when bloody discharge is a symptom, a simple mastectomy is more likely to be undertaken. This latter judgment is supported by the work of both Lepper and associates and Adair who independently have performed multiple serial sections of these specimens and remark the difficulty of finding the microscopic multiple tumors even by this careful technique.

Ten cases bearing the clinical diagnosis of probable intraductal papilloma were also studied. In 9 cases the chief complaint was of nipple discharge and in the tenth, a small tumor within the nipple. Eight of these patients were followed. Four refused surgery and report good health after 2, 3½, 2, and 4 years respectively. One of these patients mentions persistence of brownish nipple discharge. Three patients accepted simple mastectomy, but no papilloma was found in the excised tissue. These patients reported no additional trouble in 4, 4½, and 5 years respectively. One patient accepted surgery elsewhere; a papillary carcinoma was found, and a radical mastectomy performed. She reports herself in good health 7 years after surgery.

FOLLOW-UP STUDY

Table II summarizes our experience here as obtained by follow-up questionnaires, letters from referring doctors, and data from the Bureau of Vital Statistics, Department of Health, State of Texas.

In the 42 cases of unilateral or bilateral simple mastectomy for proved histologic intraductal papilloma which were followed, the patients were found to have absolutely no further trouble, to have remained in good health generally, and to have had no subsequent operations. This is in accord with Geschickter's report on 39 of 46 similar cases. No instances of supervening cancer were noted.

It might be mentioned that the 3 cases in the files here of grade 1 papillary carcinoma in association with intraductal papilloma with simple mastectomy performed were followed also. One patient is a 7 year survival in apparent good health; another is a 14 year survival for whom recently a radical procedure on the same breast was performed elsewhere for large local recurrences without evidence of distant metastases. The third patient has been followed less than 2 years and her health is reported excellent. Three additional patients had radical mastectomy performed for coexisting carcinoma grades 2 or 3. Follow-up on 2 of these patients revealed 1 survival for 2 years, and 1 death after 3 years ascribed to cancer of the breast with metastasis. Whether the foregoing 6 cases represent instances of malignant transformation of an intraductal papilloma remains conjecture.

The 34 cases followed sequential to local or wedge excision of the lesion tell a slightly different story. Further trouble is indicated by 4 of these patients. One reports another small lump near her incision. Another patient has had subsequent bilateral simple mastectomy here for breast tumors. Pathologic report was cystic mastitis in one breast and papilloma in the other. A third patient has had simple mastectomy performed upon the same breast. The fourth patient has had 6 operations on the breasts in the course of 15 years, with papillomas found in 2 instances. Although this represents only 11.7 per cent who have reported further trouble, it compares with Geschickter's reported data in which 8 of 110 (7.3 per cent) patients for whom local excision was performed were operated upon later for "recurrent" papilloma. This is especially interesting, for Geschickter advocates merely local excision for single benign papilloma. It is our opinion from these data rather that simple mastectomy is the procedure of choice for attempted cure of this condition as papillomas may be multiple, may be present in more than one duct, and, contrary to some authorities, may become malignant. There is evidence in our series that additional operations have been necessitated. There is no evidence from this study that local excision of the lesion has resulted in development of a later cancer, but the possibility of malignant change in overlooked multiple papillomas is certainly conceivable. Again, in Geschickter's group, 3 of 54 such patients, followed for more than 5 years, had developed mammary cancer. Hart, who reported upon the only comparable series in the literature with follow-up study, found strikingly similar results. Of 66 patients followed with 95 benign intraductal papillomas (69.5 per cent), none developed cancer but 9 patients were reoperated upon for another papilloma and 6 were reoperated upon for a bloody nipple discharge. Clinically, when there is a small discrete, mobile tumor at or near the areola, pressure upon which produces secretion at the nipple, a papilloma is probably present and perhaps a local excision is contemplated. However, from our study we believe that even in this type of case the patient should be told that such a tumor 1 time out of 5 (15 to 30 per cent) is multiple and reoperation may be necessary unless simple mastectomy is done at the outset.

SUMMARY

A follow-up study of 77 patients, or 88.5 per cent of 87 cases of microscopically proved intraductal papilloma seen at Scott and White Hospital in the period 1921 through 1946, has been presented. Clinical features and principles of surgical management have been discussed. Subsequent trouble in the same breast was reported in 11.7 per cent of 34 cases in which segmental excision of the lesion was carried out. In the 42 cases followed in which simple mastectomy was performed no further trouble developed. No patients in this series are known to have developed cancer of the breast sequential to operation.

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CARCINOMA OF THE THYROID GLAND

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THERE is great variation in the incidence and other characteristics of this disease, as indicated by the reports of different investigators from various parts of the country. This variation in incidence suggests that carcinoma of the thyroid gland is a geographical disease. In our report 4 years ago we noted an incidence of cancer equal to 17.1 per cent in nontoxic nodular goiter (Table I). This appeared to be an unusually high incidence of carcinoma in goiter, but since previous investigators had not broken down their series into nontoxic and toxic nodular goiter, but usually gave one figure for all types of thyroid glands encountered in the surgical pathology laboratory, there was relatively little previous data with which to compare ours. Thinking that our series, which was relatively small, might have reflected a high incidence through coincidence, we have continued the study and analyzed the cases observed in our clinic during the 3½ year period since the original publication. Of the 93 patients operated upon for nontoxic nodular goiter, between 1944 and 1948, 17.2 per cent had carcinoma. The incidence in the two periods has remained remarkably identical. Altogether in the 11½ year period since 1936, up to January 1, 1948, 17.15 per cent of the 285 nontoxic nodular goiters removed in the operating room were carcinoma. Of still more significance was the fact that of the solitary nodules which comprised about one-half of the group 24.4 per cent were carcinoma in contrast to only 9.8 per cent for the multinodular types of nontoxic nodular goiter (Table II). The incidence of carcinoma in both types of nodular goiter (toxic and nontoxic) rose from 7.2 per cent in the first series to 11.3 per cent in the latter series (1944 to 1948), but this increase should be ignored because it is explained by the relatively smaller number of toxic nodular goiters observed in the latter period.

The data in Table II reveal only 1 case of carcinoma in 517 cases of toxic diffuse goiter operated upon in the 11½ year period. This constitutes an incidence of 0.2 per cent, agreeing with the experience of others. For example, Ward encountered only 1 carcinoma in 1900 patients with toxic diffuse goiter. In 378 specimens of toxic nodular goiter removed at operation in the 11½ year period, we encountered carcinoma of the thyroid in only 4 patients. It is obvious, therefore, that presentation of figures on incidence of carcinoma on all thyroid specimens combined, as removed from the operating-room, are entirely misleading, and do not give the correct emphasis on incidence, particularly as related to types of goiter. In other words, if a toxic diffuse goiter is present, one can almost dismiss completely the possibility of carcinoma, particularly if the toxicity is of more than a mild type.

Since our initial report showing a breakdown of incidence of carcinoma in various types of goiter, other investigators have computed the incidence in each group; e.g. Crile reported a 10.9 per cent incidence of carcinoma in 274 specimens of nontoxic nodular goiter, which is considerably less than our figures. However, the incidence of carcinoma in the solitary type of nontoxic nodular goiter was almost identical to that in our series, being 24.5 per cent and 24.4 per cent respectively.

Crile has very appropriately called attention to the fact that patients who are hospitalized and operated upon for nontoxic nodular goiter have in reality been screened, particularly by the patient and the internist, and has emphasized that the incidence as reported from hospitals is not a true incidence in all patients with nontoxic nodular goiter. We agree with him on this point, but its importance appears to be minimized to a certain extent by the comparison of our statistics in

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TABLE I.—INCIDENCE OF CARCINOMA IN NODULAR GOITER (INCLUDING TOXIC, NONTOXIC AND CARCINOMA) ILLINOIS RESEARCH HOSPITAL 1936–1948

Type of goiter	1936–1944		1944–1948		1936–1948	
	No. cases	Per cent carcinoma	No. cases	Per cent carcinoma	No. cases	Per cent carcinoma
Toxic nodular	330	1.2	48	0	378	1.0
Solitary	71	0.0	17	0	88	0.0
Multinodular	259	1.6	31	0	290	1.4
Nontoxic nodular	192	17.1	93	17.2	285	17.15
Solitary	92	24.0	51	25.5	143	24.4
Multinodular	100	11.0	42	7.1	142	9.8
Total	522	7.2	141	11.3	663	8.0

TABLE II.—INCIDENCE OF CARCINOMA IN VARIOUS TYPES OF GOITER (INCLUDING CARCINOMA) ILLINOIS RESEARCH HOSPITAL 1936–1948

Type of goiter	No. cases goiter	No. cases carcinoma	Per cent carcinoma	
Toxic diffuse	517	1	0.2	
Toxic nodular	378	4	1.0	
Nontoxic nodular	285	49	17.15	8.0%
Solitary	143	35	24.4	
Multinodular	142	14	9.8	
Total	1180	54	4.6	

1936 to 1944 to those of 1944 to 1948. Following 1944, when we noted such a high incidence of carcinoma in nontoxic nodular goiter (particularly of the solitary type), we recommended thyroidectomy in every patient with such a lesion; with practically no exceptions patients accepted our advice and had a thyroidectomy performed. Even though we operated upon all these patients with solitary nodules, our incidence of carcinoma in nontoxic nodular goiter remained the same.

The supposition that goiter, including carcinoma of the thyroid gland, is a geographic disease is supported by figures from different parts of the country. For example, Rogers and associates noted that in 544,918 patients admitted to the Boston City Hospital, the Massachusetts General Hospital, and the Johns Hopkins Hospital over a period of several years, only 0.59 per cent were admitted for goiter. In 68,573 admissions to the Illinois Research Hospital during an 11½ year period, there was an incidence of 1.7 per cent goiter, which is roughly three times that of the Atlantic seaboard. After all, there is nothing new in these data since it is well known that goiter is more common in goiter belts, and figures in nongoiter belts cannot be compared to those in goiter belts. It is even more fallacious to attempt to determine the incidence of carcinoma in goiter from autopsy statistics, as has been suggested by Vanderlaan. He reports that in 18,668 autopsies performed at the Boston City Hospital over a period of 50 years, there were only 5 cases of carcinoma, and implies that this might be interpreted as data on incidence. We are convinced that autopsy figures are worthless in attempting to determine incidence of carcinoma and quote figures from the Illinois Research Hospital to support this statement. For example, during the second period (1944 to 1948) of our study, there were 675 autopsies at Illinois Research Hospital. Only 2 were for carcinoma of the thyroid. During this same interval 16 patients with carcinoma were encountered in the operating room and their condition diagnosed as such by the Department of Pathology. The astounding feature is that of the 16 patients followed in this series, we know that 11 are already dead. However, autopsies were not performed upon any of these 11 patients in our hospital; the 2 autopsies which were made during this 1944 to 1948 period belonged to the 1936 to 1944 series. It must be realized that patients with certain diseases are not referred to the hospital to die. Since these patients were able to receive all possible care as ambulatory patients, we did not refer them to the hospital when the disease became terminal, largely because the insufficient number of hospital beds available are reserved for patients for whom we hope to obtain better results than those indicated in terminal carcinoma of the thyroid. Any suggestion that our pathologists are more liberal with the diagnosis of hyperplastic lesions than others can certainly be refuted emphatically by the fact that 11 of the 16 patients with carcinoma in this latter series (1944 to 1948) are already dead, and 2 of the 5 known to be living have metastases. We know that all those who died had metas-

TABLE III.—CHARACTERISTICS OF VARIOUS TYPES OF NODULAR GOITER
Illinois Research Hospital
1936–1948

Type of lesion	Total No.	Aver. age	Sex per cent F.	Race per cent Col.	Duration mass years	No. solitary
Toxic nodular goiter (benign)	378	43.5	88.9	9.4	9.9	84(22.4%)
Nontoxic nodular goiter (benign)	285	42.4	90.1	18.0	10.2	108(37.9%)
Carcinoma of thyroid	54	48.0	67.0	13.0	6.1	35(64.9%)
Total	717					

TABLE IV.—INCIDENCE OF CARCINOMA IN NODULAR GOITER AS OBTAINED FROM NUMEROUS REPORTS IN THE LITERATURE

Author	No. patients with nodular goiter (toxic and nontoxic)	Per cent carcinoma in nodular goiter (toxic and nontoxic)	No. patients with nodular nontoxic goiter	Per cent carcinoma in nodular nontoxic goiter	Per cent carcinoma in solitary nontoxic nodular goiter
Brenizer and McKnight Charlotte, N. C. 1940	2324	4			
Horn and associates Philadelphia, Pa. 1947	1135	6.3	637	9.8	
Crile Cleveland, Ohio 1948	537	5.6	274	10.9	24.5
Ward San Francisco 1947	3539	4.8			15.6
Cole and associates Chicago 1948	663	8.0	285	17.1	24.4

tases. Although we cannot prove that the cause of death in every instance was carcinoma, yet the fact that all had demonstrable metastases should dispel any doubt regarding accuracy of the diagnosis.

Carcinoma of the thyroid is much more apt to develop in men with nodular nontoxic goiter than in women; for example, of 663 patients with nodular nontoxic and nodular toxic goiter as observed at the Illinois Research Hospital from 1936 to 1948, only 10 per cent were males contrasted to an incidence of 33.3 per cent males in 54 cases of carcinoma encountered during that same period (Table III). This indicates that the probability of development of carcinoma is about three times as great in men as in women, a point which Ward has emphasized for years. This figure is quite similar to that reported by other investigators in this field. Ward has noted further that in his entire series covering 20 years, the incidence of carcinoma in men with nodular goiter is 12 per cent, but in recent years this percentage has risen to 16.6 per cent. Our incidence of carcinoma in men with nodular goiter (toxic and nontoxic) is 17.5 per cent and likewise has shown an increase in the past few years. In our series of 54 patients with carcinoma of the thyroid the average age was 48 years, which is identical to the average as reported by Lahey, Hare, and Warren (13, 14). In fact, all investigators have reported that the average age of a patient with carcinoma of the thyroid is much lower than the average age of patients with other types of carcinoma because it is so common in young people. For example, in 62 children 14 years of age or under with nodular goiter, Kennedy encountered carcinoma in 12 cases, representing an incidence of 19.3 per cent. This series alone emphasizes the seriousness of goiter in young people. Ward noted an incidence even higher, namely 40 per cent in 10 children under 15 years of age with nodular goiter. The percentage of colored people in our series of carcinoma of the thyroid was 13 per cent, which is identical to the percentage of colored patients in our group of nodular goiter, toxic and nontoxic.

The average duration of the mass in our patients with carcinoma was 6.1 years (Table III). In our patients with toxic nodular (benign) goiter the average duration of the mass was 9.9 years, as compared to 10.2 years for nontoxic nodular (benign) goiter. The 6.1 year history of a mass in the neck in patients with carcinoma appears to be fairly good evidence that carcinoma develops in pre-existing nodules or adenomas. In fact, almost all investigators in this field agree that most carcinomas of the thyroid have onset in benign nodules or adenomas, frequently of the fetal adenoma type.

RELATIONSHIP TO HYPERTHYROIDISM

Carcinoma is extremely uncommon in toxic diffuse goiter. For example, in 517 cases of toxic diffuse goiter operated upon during the

TABLE V.—PATHOLOGIC TYPES IN 54 CASES OF THYROID CARCINOMA OBSERVED IN ILLINOIS RESEARCH HOSPITAL 1936–1948

Type	Number	Per cent
1. Papillary adenocarcinoma	15	27.7
2. Alveolar adenocarcinoma	11	20.4
3. Hürthle cell adenocarcinoma	7	12.9
4. Small cell diffuse carcinoma (carcinoma simplex)	4	7.5
5. Giant cell carcinoma	1	1.9
6. Fibrosarcoma	1	1.9
7. Carcinoma, type undetermined*	15	27.7
Total	54	100.0

*If Shields Warren's classification were used, many of these would be classed as malignant adenoma.

past 11½ years, we encountered only 1 carcinoma. Ward encountered 1 case of carcinoma in 1900 cases of toxic diffuse goiter. Carcinoma is more common in toxic nodular goiter, but in general is so uncommon in toxic goiter that presentation of a figure on incidence of carcinoma *for all types of goiter are in reality misleading*, since the incidence is so many times more common in nontoxic nodular goiter. We encountered 4 patients with carcinoma in 378 patients having thyroidectomy for toxic nodular goiter. All together, hyperthyroidism was associated with carcinoma of the thyroid in 9 per cent of our series, but in general was quite mild in type.

There is considerable variation in figures presented by other workers. The highest incidence is that reported by Pemberton and Lovelace (17, 18), namely 33.5 per cent. However, this figure is far above most of the other figures in the literature. Horn and associates noted that thyrotoxicosis was present in 9 per cent of 71 cases of carcinoma studied by them. McSwain and Diveley encountered definite hyperthyroidism in 10 per cent of 22 cases of carcinoma and doubtful hyperthyroidism in an additional 10 per cent.

There is controversy as to the origin of the thyrotoxicosis when it occurs with carcinoma. However, after a study of 396 patients with carcinoma of the thyroid, Friedell arrived at the conclusion that the carcinomatous area itself does not have the function of hyperthyroidism. We agree with this conclusion, but are aware of a few instances in which the metastases appeared to have produced hyperthyroidism.

PATHOLOGY

It is not our intention in this paper to discuss the details of pathology of carcinoma. As previously stated, most authorities working on this subject are of the opinion that carcinoma of the thyroid has its origin in benign nodules or adenomas in a large percentage of cases. A classification of Shields Warren includes malignant adenomas as one of the types observed, although some pathologists prefer to place these tumors in other categories. Table V reveals the types of tumors encountered in our series. Twenty-seven per cent are shown as lesions which some pathologists might classify as malignant adenomas. It is important that this group, which is classified by some authors as malignant adenomas, is slow to metastasize as are also the papillary carcinomas. In our series 27.7 per cent were papillary carcinomas. In other series the incidence of this type of tumor is higher. In 517 cases of carcinoma of the thyroid Pemberton (17, 18) reports 30 per cent as being papillary carcinoma, 38 per cent as carcinoma in adenoma, and 30.4 per cent as diffuse adenocarcinoma.

There is considerable difference of opinion as to the incidence of malignancy in lateral aberrant thyroids. After analyzing 34 cases of lateral aberrant thyroid nodules, Lahey (12) reports that 35 per cent were carcinoma. Crile noted that "in nearly half the cases of lateral aberrant thyroid disease, the lobe of the thyroid on the affected side contained a tumor histologically identical with the lateral cervical nodes." King and Pemberton (11) considered all such nodules as metastases from the homologous lobe of the thyroid. After a study of 112 cases, Black has concluded that lateral aberrant thyroids are metastases from primary lesions in the thyroid and are practically always of the papillary adenocarcinoma type.

DIAGNOSIS

Unfortunately, there are no early symptoms of carcinoma of the thyroid except rapid increase in the growth of the nodule in the neck. The remainder of the symptoms as noted below are in reality late symptoms. The

first complaint noted after increase in the size of the mass in the neck is apt to be a feeling of pressure in the neck, particularly when the patient moves his head in certain directions. Hoarseness is fairly common and is indicative of pressure on one of the laryngeal nerves or invasion of the larynx or trachea itself. Persistent cough with excessive mucus is not uncommon. Difficulty in breathing and swallowing are later symptoms and usually indicate invasive growth of the tumor compressing the trachea or larynx, or esophagus respectively. Along with difficulty in breathing, stridor is occasionally noted, particularly while the patient is asleep.

Soley and associates have called attention to the fact that pressure symptoms are by no means pathognomonic of cancer of the thyroid. For example, in 72 of 81 patients with nonmalignant nodular goiter, pressure symptoms of one type or another were present. This incidence is remarkably similar to the incidence of pressure symptoms in carcinoma of the thyroid, insofar as 12 of 15 patients with carcinoma had one or more types of pressure symptoms.

Examination of the mass is helpful but by no means will make a positive diagnosis, since the consistency of the different types of tumors varies. Obviously, any indurated tumor mass must be considered as potentially malignant, although thyroiditis is about as common and must be ruled out. Of more value than consistency of the tumor is the presence of metastatic nodules in the neck.

Considering the manifestations described, it is obvious that it will be very difficult to make a preoperative diagnosis in a high percentage of cases, as is borne out by actual experience. For example, McSwain and Diveley report that in 27 per cent of their series of carcinoma of the thyroid, the diagnosis was not suspected preoperatively. In the series reported by Pemberton (17, 18), carcinoma was unsuspected in 60 per cent. In our report (2) 4 years ago, our figure on preoperative diagnosis actually was less than reported above. However, since that time we have made much greater effort to differentiate benign from malignant lesions of the thyroid, but have been able to make a correct preoperative diagnosis in no more than 75 per cent of cases; even then we had to have the assistance of preoperative biopsy to attain this figure.

However, Crile reports an accuracy of 90 per cent preoperative diagnosis of carcinoma of the thyroid, although he admits that it may not be possible to maintain a percentage accuracy as high as this.

TREATMENT

Since it appears that carcinoma of the thyroid frequently develops within benign nodules, the removal of nontoxic nodular goiter becomes an important method of therapy in the treatment of carcinoma of the thyroid although it is obviously prophylactic. Practically all the authorities reporting on the incidence of carcinoma have arrived at the conclusion that all nodular goiter of the solitary type should be removed. The authors agree with this conclusion. Hinton and Lord made a study of the incidence of carcinoma in 184 patients with clinically benign nodular goiter (toxic and nontoxic) finding that 7.6 per cent were carcinoma. In 75 patients with clinically benign lesions of the breast, carcinoma was encountered in 6.7 per cent of the group. They, therefore, conclude that there is actually more reason for removing an apparently benign nodule in the thyroid than an apparently benign nodule in the breast. They emphasize that practically all physicians advise removal of all nodules in the breast even though they appear benign. After this study they conclude that "all nontoxic nodular goiter should be removed because of the high incidence of unsuspected cancer, a rate which exceeds that of cancer of the breast in the clinically benign appearing group." Practically all surgeons now agree that even though a nontoxic nodule in the thyroid appears quite definitely to be benign, it *must not be removed by simple enucleation*, but that a subtotal thyroidectomy of the affected lobe should be done, because early carcinoma is so frequently found in the nodule.

Opinions differ somewhat as to the actual type of treatment, although it is agreed that surgery and irradiation therapy (including radon seeds) are extremely valuable. The authors favor radical dissection of the neck in all cases of carcinoma of the thyroid except

TABLE VI.—FIVE YEAR SURVIVAL RATES IN CARCINOMA OF THE THYROID AS REPORTED BY NUMEROUS OBSERVERS IN THE MEDICAL LITERATURE

Author	No. patients followed 5 years	Per cent 5 year survival
Pemberton Rochester, Minn. 1938	421	61
Horn and associates Philadelphia, Pa. 1947	42	55
Cole and associates Chicago, Ill. 1948	36	38
Portmann Cleveland, Ohio 1940	149	35.5
DeQuervain Switzerland 1935	108	17.5
Dargent Lyon, France 1941	135	9.6
Watson and Pool New York 1940	167	7.8

those in which a small carcinoma is found within the thyroid tissue in the surgical pathology room. By radical dissection of the neck we mean excision of the sternomastoid muscle, internal and external jugular, the ribbon muscles, and all areolar and lymphatic tissue on the affected side. Details of the operation may be found in the publications of Lahey (13, 14), and Watson and Pool. Some surgeons (Crile) are not convinced that radical resection adds a great deal to the ultimate results. Black is of the opinion that radical dissection is not necessary in the malignant lateral aberrant thyroid.

Radium and x-ray treatment are quite effective in certain types of lesions particularly the papillary adenocarcinoma. Either or both of these types of therapy should be utilized in every patient with carcinoma of the thyroid revealing metastases, regardless as to whether or not radical resection has been performed.

When radioactive iodine was introduced as a method of treating carcinoma of the thyroid, great hope was held out for good results, since it was known that the thyroid gland picked up iodine from the blood stream. However, reports from numerous workers have not been very encouraging. For example, Marinelli reports that in 19 cases of carcinoma of the thyroid only 11 took up radioactive iodine. Rawson reports that in 12 patients with carcinoma only 5 took up iodine, whereas all benign tumors of the thyroid did. In 8 cases the metastatic nodules took up radioactive iodine but not in quantities as great as did normal tissue. They concluded that this function which was present in normal thyroid to a great extent, was actually lost when carcinoma developed. Ward reports that in 10 patients of the California series, treated with radioactive iodine, there was no measurable pick-up of radioactive iodine in 7. From the reports mentioned, it is rather obvious that radioactive iodine will contribute very little to the treatment of carcinoma of the thyroid except in the occasional case.

RESULTS

The operative mortality following thyroidectomy for carcinoma of the thyroid will be somewhat higher than thyroidectomy for benign lesions of the thyroid, but will vary depending largely upon the percentage of radical neck dissections. Pemberton reports an operative mortality rate of 1.8 per cent. Portmann noted a mortality rate of 8.5 per cent, although many of these patients are drawn from records many years ago. We had 1 operative death in 36 patients upon whom we did a thyroidectomy or thyroidectomy with radical neck dissection, constituting a mortality rate of 2.7 per cent. Seven of these 36 patients had radical neck dissections without operative fatality.

In general it is agreed that the best results will be obtained in papillary carcinoma, Hürthle cell carcinoma, and malignant adenoma, perhaps in the order named. After studying their series of cases, McSwain and Diveley concluded that the duration of the mass in the neck had no bearing on prognosis. Dailey emphasizes that the presence of distant metastases should not be considered too seriously in issuing a pessimistic prognosis. For example, he noted that 10 of 90 patients studied by him had remote metastases for 3 to 17 years. All investigators studying the problem of carcinoma of the thyroid have known of patients with metastases in bone or other organs

which have been present for years without much evidence of spread.

There is an enormous variation in the 5 year survival rates reported by various authors. For example, in 421 patients followed for 5 years at the Mayo Clinic, Pemberton (17, 18) reports 61 per cent 5 year survivals (Table VI). On the contrary, Watson and Pool reported only 7.8 per cent 5 year survivals in 167 patients, and Dargent reported only 9.6 per cent in 135 patients. De Quervain reported a slightly higher rate of 17.5 per cent in 108 cases followed 5 years or more. Our series of patients, observed 5 years or longer, is quite small. Of 36 patients having complete follow-up, 38 per cent survived 5 years or longer. The survival rate for our late series will probably be less than this, since in 11 of the 16 cases followed (3 months to 5 years) death has already occurred.

It is difficult to explain the wide variation in 5 year survival rates as reported above. It is assumed that certain observers may be more lenient in allowing doubtful cases to be classified as carcinoma; however, the authors are not at all convinced that this is the sole explanation. We are convinced that coincidence and geographic location are probably of greater importance in this variation of figures, largely because the incidence of papillary carcinoma (particularly of the lateral aberrant type) and other relatively slow growing tumors will show great variation geographically. It is quite obvious that in the 16 patients, followed closely during the past 4 years, we have been dealing with a very vicious type of tumor, since 11 are already dead.

As in other types of malignant tumors, the relative curability is dependent upon how extensively invasion has taken place when treatment is instituted. For example, Ward found that in patients whose disease was diagnosed before operation, the 5 year survival rate was 20 per cent, whereas in those patients whose condition was diagnosed only after examination of the specimen in the surgical pathology room it was 80 per cent.

SUMMARY

During the past 11½ years we have encountered 54 patients with carcinoma of the thyroid in 663 patients having thyroidectomy for nodular goiter, constituting an incidence of 8 per cent. The incidence of carcinoma in toxic nodular goiter was only 1 per cent, contrasted to 17.15 per cent in nontoxic nodular goiter.

In a study made by us (2) 4 years ago the incidence of cancer in nontoxic nodular goiter was 17.1 per cent. Since this appeared unusually high, we have analyzed the data during the past 4 years and found it to be almost identical, namely 17.2 per cent. Of the solitary nodules, which comprised half of the group of nontoxic nodular goiters, 24 per cent were cancer, in contrast to only 9.8 per cent for the multinodular type of nontoxic nodular goiter. Statistics on cancer including all types of goiter are entirely misleading because the incidence is so low in toxic goiter. The incidence of cancer in our series of 517 patients with toxic diffuse goiter was only 0.2 per cent.

Goiter, including cancer of the thyroid, is a geographical disease. The ratio of goiter to all admissions in our hospital is three times greater than in hospitals along the Atlantic seaboard. It is worse than worthless (i.e. entirely misleading) to attempt to determine the incidence of cancer in goiter from autopsy statistics. Our study of patients encountered in our clinic during the past 4 years reveals the fact that 11 of the 16 patients with carcinoma of the thyroid are already dead from their cancer; yet none of these 16 was autopsied in our hospital. One or two died in other hospitals; the rest died at home.

The danger of cancer in goiter is about three times greater in men than in women. The average age of patients with carcinoma of the thyroid is much lower than the average age of patients with other types of cancer because it is so common in young people. Most carcinomas have onset in benign nodules or adenomas as indicated by the fact that the average duration of the mass in our combined series was 6.1 years.

The preoperative diagnosis in early cases is extremely difficult. During the past 4 years when we have been extremely careful in the diagnostic study of our cases we have been able to make a correct diagnosis in no more than 75 per cent of patients with carcinoma;

even then we had the advantage of a biopsy in a few cases. Rapid increase in the growth of the nodule, a feeling of pressure, hoarseness, persistent cough, difficulty in breathing, and an indurated tumor mass are of help in making this diagnosis. The first symptom is the earliest; the remainder are usually indications of metastases or invasion outside the gland.

When a cancer of the thyroid has invaded the capsule or metastasized to cervical lymph nodes, it should be treated by radical neck dissection and radiation therapy, sometimes including radon seeds. Reports of other investigators indicate that radioactive iodine will be of only slight help in controlling this disease.

The 5 year survival rate as reported by numerous authors varies greatly (from 61 to 7.8 per cent in 7 reports reviewed by us) due in part to the different criteria used in making the microscopic diagnosis, and in part to geographical locations. In our series it was 38 per cent, but in our late cases, the figure will probably be lower since 11 of 16 patients observed during the past 4 years are already dead.

The incidence of cancer in the solitary type of nontoxic nodular goiter is so high in our locality that we advise removal of all solitary nodules, but perform subtotal hemithyroidectomy rather than enucleation because early cancer will be found unexpectedly in a surprisingly large number. During the past 4 years we have advised and removed practically all solitary nodules encountered in patients in our clinic, but in spite of this the ratio or per cent of cancer has not decreased over that encountered in our initial series reported 4 years ago.

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PREOPERATIVE EVALUATION OF LIVER FUNCTION IN PATIENTS WITH CIRRHOSIS OF THE LIVER

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THE great strides that have been made in the protective and supportive measures for the treatment of the impaired liver have enabled the surgeon of today in most instances to undertake and carry out successfully long and tedious operative procedures. These advances bring into focus the importance of accurate preoperative evaluation of the extent of liver damage and its functional capacity in a given case.

An analysis of 44 cases of disease of the liver (42 of cirrhosis) in which the operation of portacaval anastomosis was performed affords some opportunity of correlating the preoperative evaluation of the status of the liver with its postoperative behavior.

It became apparent early in the series that no single liver test employed by us afforded consistently adequate information upon which to predict the behavior of the liver postoperatively in a given case. On the other hand, there was the occasional patient whose postoperative progress was better than could be anticipated on the basis of several preoperative liver tests.

This is best illustrated by citing the case of an 18 year old girl who gave a 5 year history of progressive, unremitting, painless jaundice. Hepatosplenomegaly was known to have existed for 2 years prior to her admission to the Presbyterian Hospital. A dietary medical regimen for cirrhosis of the liver was without effect in this case. Over the years there had been a progressive severity of the jaundice with decline in the serum albumin. A liver chemistry survey 6 months prior to admission revealed a 2+ cephalin flocculation reaction; serum albumin was 3.2 per cent, globulin 4.4 per cent, and cholesterol esters less than 50 per cent of the total. On admission, the cephalin flocculation was 4+, thymol turbidity, 4+; serum albumin, 3 per cent, globulin, 2.9 per cent; serum phosphatase, 3.9 Bodansky units per cent; bromsulfalein retention 45 minutes after injection was 37 per cent; the galactose removal constant was 50 per cent of normal (2.1); the prothrombin time was 60 per cent of normal and the serum bilirubin 3.6 milligrams per cent.

The spleen was markedly enlarged. A venous hum could be heard below the xyphoid process. All concurred that this patient was a bad operative risk. Nevertheless she tolerated the operation of splenectomy and anastomosis of the splenic vein to the renal vein surprisingly well. Postoperatively, as evidence of further depressed liver function, she developed edema and ascites on the third day. There was anorexia and lassitude but the patient took a high protein diet courageously, and following a paracentesis on the sixth postoperative day there was no further recurrence of the ascites. By the seventh postoperative day the serum bilirubin had dropped 30 per cent below its preoperative level. At the end of 3 weeks the serum albumin had risen to 3.4 per cent.

At the time of discharge on the thirty-ninth postoperative day, the patient was free of jaundice for the first time in 5 years. The total serum proteins had risen to 8.3 per cent (albumin 4.8 per cent, globulin 3.5 per cent). The cholesterol esters had risen from a preoperative figure of less than 50 per cent to 66 per cent of the total cholesterol. There had been improvement in the bromsulfalein and galactose tolerance liver function tests. The thymol turbidity test had become reduced from 4+ to 2+ and the cephalin flocculation test, which before operation had been consistently strongly positive, had returned to normal.

This case has been cited in some detail to illustrate two additional points namely: (1) Results of tests designed to indicate liver damage and/or impairment of function do not

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TABLE I

Case No. Hospital No.	Preoperative liver chemistry	Postoperative course
1 767171	Cephalin flocculation, 4+; serum albumin, 2.9%; globulin, 3.7%; serum bilirubin, 2.7 mgm.%; serum phosphatase, 9.5 B.U.%; bromsulfalein retention ½ hr., 70%	Anorexia, weakness, temporary recurrence of ascites
2 850996	Cephalin flocculation, 3+; serum albumin, 3.3%; globulin, 5.2%; serum phosphatase, 10.7 B.U.%; serum bilirubin, 1.9 mgm.%; hippuric acid excretion, 0.8 gm.; bromsulfalein retention ½ hr., 42%	Ascites reappeared requiring one paracentesis. Wound disrupted
3 868165	Cephalin flocculation, 3+; serum albumin, 3.5%; globulin, 2.9%; serum phosphatase, 6.1 B.U.%; serum bilirubin, 1.3 mgm.%; bromsulfalein retention 45 min. after injection, 23%; prothrombin time 50% of normal	Ascites reappeared transitorily
4 900615	Cephalin flocculation, 4+; thymol turbidity, 4+; serum albumin, 3%; globulin, 2.9%; serum bilirubin, 3.6 mgm.%; serum phosphatase, 3.9 B.U.%; galactose removal constant, 2.1; bromsulfalein retention 45 min., 37%; prothrombin time 60% of normal	Ascites occurred on 3rd postoperative day requiring 1 paracentesis
5 784905	Cephalin flocculation, negative; serum albumin, 2.9%; globulin, 2.3%; serum phosphatase, 3 B.U.%; bromsulfalein retention ½ hr., 35%	Ascites recurred and persisted for several months, finally disappearing as the serum proteins rose
6 817310	Cephalin flocculation, negative; serum albumin, 3%; globulin, 2.3%; serum bilirubin, 2.5 mgm.%; serum phosphatase, 4.6 B.U.%; bromsulfalein retention ½ hr. after injection, 40%	Ascites reappeared but proved transitory. Became more jaundiced for a week postoperatively
7 783972	Cephalin flocculation, negative; serum albumin, 2.3%; globulin, 3%; serum phosphatase, 10.2 B.U.%; hippuric acid excretion, 0.6 gm.; bromsulfalein retention ½ hr., 40%	Anorexia, weakness. Recurrence of ascites requiring 1 paracentesis on 8th postoperative day

always correlate well with the pathologist's interpretation of disease on the basis of microscopic examination of fixed and stained sections taken from a biopsy specimen of the liver. (2) Discrepancies occur between the surgeon's report on the gross examination of the liver and the pathologist's report on the microscopic examination of a biopsy specimen.

The pathologist's report on the biopsy specimen of this girl's liver was as follows: "Fatty infiltration, more marked in the periportal areas. No cellular infiltration and but little fibrosis." The facts of the matter are that the pathologist did not see enough evidence upon which to base the diagnosis of cirrhosis and the biopsy specimen was classified as "undiagnosed condition of the liver."

The surgeon's observations at operation are decidedly in keeping with the long clinical history, the physical findings, and the laboratory studies in this case. The right lobe of the liver was contracted and its surface studded with irregular sized nodules. The consistency was abnormally firm. The left lobe was enlarged but otherwise appeared normal on gross examination. A portal pressure reading taken from the splenic vein revealed the presence of portal hypertension.

The cephalin flocculation reaction is interpreted by many to indicate active liver cell injury in cases of cirrhosis of the liver. Hanger and Patek's observations are of interest.[1] These authors correlated the cephalin flocculation and the clinical course of 40 patients having cirrhosis of the liver. The cephalin flocculation reactions were consistently strongly positive (3+to 4+) in 17 per cent of the 40 cases. Twelve of the 17 patients died and 4 additional had a clinical course that was classified as unfavorable or stationary; in only 1 case was the clinical course favorable. In 12 of the 40 patients the cephalin flocculation reaction was progressively diminishing. This group had a decidedly more favorable clinical course. Only 3 patients died, the remaining 9 having a favorable clinical course. Finally, there were 11 of the 40 who had a persistently weak or negative flocculation reaction. Three patients died in this group and 8 had a favorable clinical course.

In our series of 44 patients having disease of the liver in which the portacaval anastomosis operation was performed there were 10 postoperative deaths. It is of interest to note that the cephalin flocculation reaction was strongly positive (3+ to 4+) in 8 of the 10 cases. In 1 case, the test was not recorded as having been done and in 1 case the test was weakly positive.

It must be remembered, however, that in the group of postoperative deaths, the liver played no role in the cause of death in at least 3 of the 10 deaths. Furthermore, one must keep in mind that whereas the cephalin flocculation reaction is important it can present but one part of the total picture in the preoperative evaluation of the status of the

[1]Hanger, Franklin M., and Patek, Arthur J. Jr. Am. J. M. Sc., 1941, 202: 48-52.

liver. This is well illustrated by the fact that 11 of the 20 patients with strongly positive cephalin flocculation reactions did withstand the portacaval shunt procedure successfully.

To obtain an over-all perspective of the relative values of the different liver tests employed in terms of the postoperative behavior of the liver, it is well perhaps to illustrate with cases. I have selected 7 patients whose postoperative course for a short while was punctuated by unmistakable evidence of further depression of liver function even though they had survived the portacaval shunt procedure.

Table I shows the preoperative liver studies and the postoperative comments on the 7 cases. In respect to the latter it is to be noted that ascites appeared postoperatively in all 7 cases. Ascites occurring during the postoperative course in a patient whose portal hypertension has been relieved through the establishment of a portacaval shunt is interpreted by us to mean unmistakable clinical evidence of severe depression of liver function.

One is impressed by one fact in comparing the array of liver studies in the different cases, namely, the importance of no single test to the exclusion of others. The best example of this is the cephalin flocculation reaction which is strongly positive in 4 cases and totally negative in 3. I am inclined to believe, however, that the type of cirrhosis is a factor in this particular discrepancy. The 3 instances of negative flocculation tests were in cases of Laennec's cirrhosis; whereas, in our opinion, in 3 of the 4 cases of strongly positive cephalin flocculation reactions, the cirrhosis was of the posthepatitis variety.

Any positive advantage of the negative cephalin flocculation reaction in Cases 5, 6, and 7, would seem to be well offset by extremely low albumin percentages and the marked impairment on the part of the liver to excrete bromsulfalein. The serum bilirubin is noted to be elevated in 5 of the 7 cases.

By all odds the patient in Case 4 has the worst over-all picture and, with the exception of 1 patient (Case 5), she had the stormiest postoperative course.

The most consistent findings throughout the series of 7 cases is the marked inability of the liver to excrete bromsulfalein and make albumin. The quickest postoperative deaths from liver failure in our experience occurred in 2 patients each of whom preoperatively had a serum albumin level of 2.4 per cent. One patient was in coma and died on the second postoperative day with a blood nonprotein nitrogen of 136 milligrams per cent. The other patient died in coma on the fourth day with a blood urea of 74 milligrams per cent. One of the patients had a severe unremitting jaundice and the other had a bromsulfalein retention of 40 per cent ½ hour after injection.

CONCLUSIONS

Our experience would indicate that patients with cirrhosis, who have serum albumin levels of 3 per cent or under with bromsulfalein retention in excess of 35 per cent ½ hour after injection, are in general not good operative risks. Careful study of individual cases, however, will reveal, even in this group, a wide margin of risk. Particularly is this true in posthepatitis cases. It is remarkable how many of these patients can be brought through a shunt procedure safely if care is exercised in the selection of the time to operate, the preoperative preparation, and the postoperative handling.

THE EFFECT OF REDUCED BLOOD FLOW TO THE LIVER IN RENAL HYPERTENSION

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THE modern theories concerning the causative factors of vascular hypertension and of their interrelationships may be stated as follows:

(A) Renin, a protein-like substance, is formed in excessive amounts by an "ischemic" or "anoxemic" renal parenchyma. Hypertensinogen, the precursor of hypertensin, is an alpha-globulin substance formed in the liver and has a specificity for reacting with renin, produced in the kidney, to form hypertensin, the vasopressor substance.

(B) The existence of a hitherto undescribed homeostatic system for the regulation of the peripheral circulation has been disclosed in recent studies (3). "This system is made up of two components, one of hepatic (V.D.M.), the other of renal origin (V.E.M.). Evidence of the presence of such a circulatory homeostatic system, its mode and sites of origin, and the manner in which it regulates the behavior of the peripheral vascular bed, was first derived from studies on experimental hemorrhagic and traumatic shock. Subsequent studies have shown this homeostatic system to be likewise involved in the syndrome of experimental renal hypertension." The most probable mechanism responsible for the formation of these vasotropic factors during the shock syndrome is, as was pointed out, the reduced oxygen tension resulting from the reduction in blood flow to the liver and skeletal muscle (V.D.M.), and the kidney (V.E.M.).

Since it has been demonstrated that the plasma level of hypertensinogen is maintained by its production in the liver, and since a decrease in hypertensinogen is described only in some cases of experimental acute liver insufficiency (2), we have attempted to produce low grade hepatic pathology to inhibit the formation of hypertensinogen, and thereby relieve an experimentally produced hypertension. On the other hand, reducing the blood flow to the liver should increase the formation of the vasodepressor factor considered to play a role in the homeostatic system involved in the syndrome of experimental renal hypertension.

To date, we have produced renal hypertension in 5 dogs by the Goldblatt and Grollman methods and subsequently have partially occluded their hepatic arteries and portal veins to cause a relative anoxemia of the liver parenchyma. Goldblatt clamps were used to maintain a uniform and consistent caliber of the vessels. We have found a substantial reduction in the systolic blood pressure of each of the 5 animals following the reduction of the blood flow to the liver. Three of these experiments are summarized in Table I. The renal hypertension was induced by clamping the renal arteries with Goldblatt clamps, or by compressing one kidney and removing the other in a two stage operation according to the method of Grollman. In our experience, the Goldblatt procedure produces an earlier rise and a better sustained hypertension in dogs than does the Grollman technique.

A Goldblatt clamp was placed on the portal vein at the entrance of the vessel into the liver above the splenic vein. The lumen of the clamp, when it is completely open and in place, is enough to reduce about one-half to two-thirds of the portal flow without producing symptoms in the animal. Another Goldblatt clamp was placed on the common hepatic artery after infiltration of the periarterial tissue with procaine solution. The hepatic plexus which surrounds the artery was carefully stripped off; this procedure avoided the vasoconstriction produced by manipulating the artery and leaves the caliber of the vessel normal. This step is essential in order to place

From the Department of Surgery Northwestern University Medical School aided by a grant from the Lois Grunow Surgical Fund.

TABLE I.—SUMMARY OF 3 EXPERIMENTS

Dog	Renal surgery	Blood pressure	Partial occlusion of portal vein and hepatic artery	Blood pressure	Course
9	5–13–48 Bilateral Goldblatt clamps	6–8–48: 180 mm. Hg	6–8–48 Prothrombin concentration 7–16–48: 90% 7–23–48: 90% 7–23–48: 70% 9–24–48: 80% 11–10–48: 90%	6–17–48: 150 mm. Hg 6–19–48: 130 mm. Hg	Portacaval shunt, 12–3–48 Biopsy of liver 12–3–48 Blood pressure 138 mm. Hg
15	7–16–48 Bilateral Goldblatt clamps Prothrombin concentration preoperatively: 100%	7–27–48 175 mm. Hg Prothrombin concentration 7–23–48: 110%	7–30–48 Hepatic artery clamp adjusted 9–1–48 Prothrombin concentration 7–30–48: 80%	8–11–48: 190 mm. Hg 8–23–48: 150 mm. Hg 8–31–48: 170 mm. Hg 9–3–48: 150 mm. Hg Prothrombin concentration 11–10–48: 90%	Blood pressure has remained at 150 mm. Hg for 120 days
18	Grollman method 8–4–48 Left kidney compressed by figure of 8 ligature 8–20–48 Right kidney removed	8–31–48: 180 mm. Hg	9–9–48 Prothrombin concentration 9–22–48: 100%	9–14–48: 140 mm. Hg 10–12–48: 80 mm. Hg 11–9–48: 120 mm. Hg Prothrombin concentration 10–18–48: 90% 11–10–48: 80%	Blood pressure has remained at 120 mm. Hg for 111 days Portacaval shunt 12–29–48

the clamp and adjust it to obtain a uniform reduction of the lumen of the vessel. For this purpose, the screw of the Goldblatt clamp is completely tightened down and then one complete turn to release it is made.

After the operation the dogs showed no symptoms of illness. They remained alert and ate normally although most of them lost weight. A portal hypertension developed at the end of 2 to 3 months evidenced by dilatation of the veins in the abdominal wall. The liver showed a bright yellow color with a distinct lobular pattern. Fluid was not present in the peritoneal cavity. Histological studies of the liver will be reported upon elsewhere. Prothrombin determinations of the plasma were made periodically to detect any degree of liver injury produced by the reduced liver circulation. Variations between the normal limits always were found although some may be considered as low normal. One dog showed a reduction of 50 per cent.

In 2 dogs 130 and 111 days after the operation, a portacaval anastomosis was performed to relieve the portal hypertension and to observe the effect on the arterial blood pressure of diverting the apparently increased blood volume of the splanchnic area. To date no change in the arterial blood pressure has been observed 30 and 20 days after this operation (Table I).

Work is in progress to investigate whether reduction of the hepatic or portal circulation is more important. Preliminary results show that by ligating the branches of the hepatic artery that enter the liver, a steady decline of systolic blood pressure is obtained in hypertensive dogs (Goldblatt type).[1] Experiments are also under way to determine if the surgical procedure of reducing the blood flow to the liver interferes with the production of hypertensinogen or increases the formation of the vasodepressor substance of Shorr, Zweifach, Furchgott, and Balz (V.D.M.).

[1]Ligation of the liver branches of the hepatic artery in the normal dog have long been known to result in death within 24 to 36 hours. If penicillin is given immediately following the ligation, the dogs live. This latter experiment has been carried out in our laboratory for the past 6 months. Markowitz, Rappaport, and Scott (3) learned the same fact independently and have reported their result.

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EDITORIALS

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SEPTEMBER, 1949

THE RH FACTOR

THE discovery of this constituent of human blood by Landsteiner and Wiener in 1940 and the further studies carried out by Wiener and his associates, by Levine and his coworkers, by Edith Potter, by Diamond, and by Hill and Haberman, of this country, have aided in the clarification of previously unexplainable transfusion reactions and in solving the mystery of hemolytic disease of the newborn (commonly called erythroblastosis fetalis). Noteworthy contributions to this subject have also been made by Coombs, Race, Taylor, Fisher and Mourant, of England, and by Chown, of Canada.

The Rh factor is really a complex, composed of the subgroups Rh_o, Rh′, and Rh″. Eighty-five per cent of Caucasians possess the Rh_o factor along with one or both the others; about 3½ per cent possess only one factor, and about 13 per cent lack all 3 factors. The latter are the true Rh negative persons, though this term is universally applied to those lacking the Rh_o factor. In other races 98 per cent or more possess the Rh factor, and it has been suggested that those who do not probably have an admixture of white blood.

The Rh factor acts as an antigen and may stimulate the production of antibodies if introduced into the blood of an Rh negative individual. This may be accomplished by blood transfusion or by pregnancy produced in an Rh negative woman by an Rh positive man. Here the red blood cells evidently pass from fetus to mother through microscopic lesions in the placenta, probably seeping through all during the pregnancy. Some contend, however, that this transfer occurs most often during labor. At any rate, it appears that in pregnancy the process of antibody formation is a gradual one, so that in the first pregnancy they cannot be detected. Once the antibodies are formed, they may cross the placental barrier from mother to child in a subsequent pregnancy and attack the red cells carrying the Rh factor, thus producing hemolytic disease. Three types can be differentiated clinically; the hydropic (mortality, nearly 100 per cent), the icteric (40 to 50 per cent fatal), and the anemic (with a risk of 15 to 20 per cent). The infant may die in the uterus days or weeks before delivery, may die shortly after birth, or may survive, especially when promptly and properly treated. Once sensitization of a woman is established, it persists throughout life, and if she has lost a child from hemolytic disease, all subsequent Rh positive children borne by her will suffer the same fate. However, this mother-to-child antibody transfer does not always occur, or it may be so slight as to be of no consequence. Furthermore, about 50 per cent of such women are not capable of sensitization.

These antibodies may be of the type that cause agglutination of the red cells in saline, or they may be of the "blocking" or "incomplete" variety which prevent or "block" the agglutinating property of the first type because of their greater affinity for the combining units on the red cells. They agglutinate Rh positive cells in a protein medium. They result from more prolonged immunization, and may ultimately replace the simple antibodies, hence their presence, especially if found alone and in high titer, establishes a more serious (but by no means is this infallible) prognosis for the present, or any future infant. If one or both antibodies are found persisting in the maternal blood months or years after delivery, the outlook in a future pregnancy is especially somber.

Of the 15 per 100 females who are Rh negative, some are not in the childbearing age, some are not married, and a few are married to Rh negative men. Hence only about 9 per cent of all pregnancies occur in Rh negative women married to Rh positive men, and, as noted above, many of these women are not susceptible of sensitization. Furthermore, about 58 per cent of Rh positive men are heterozygous for the Rh factor, hence that percentage of their children should be Rh negative. Thus, only in about 1 to 350 (some say 1 to 500) deliveries will the child be affected in varying degree with hemolytic disease of the newborn. This will not occur in the first term pregnancy unless the mother has been sensitized by blood transfusion or by a pregnancy which has progressed to 4 or 5 months or more before abortion occurred. The disease is most often noted in the second or third and subsequent pregnancies, rarely not until the fifth or sixth. In 569 consecutive patients in our private practice, our group found 98, or 17.3 per cent, of the women to be Rh negative. Of these, the potentiality of Rh sensitization was present in 43. In 24 women it did not develop, in 10 it was found, 8 were still undelivered, and in 1 he outcome was not known. Of the 10 women, 6 lost a total of 8 babies. Thus, 1.05 per cent of these 569 women lost their babies from hemolytic disease. This is much higher than the ratio usually given.

Three Hr factors, the reciprocals of the corresponding Rh factors, have been found. Of these, only the Hr′ is capable of producing antibodies, and that very rarely. Davenport of New Orleans, in thousands of studies, has found only 1 such case, a quadroon at the Charity Hospital.

As stated, once sensitization is established, it is permanent. The recent work with the haptens by Carter offers great promise of combatting this, but much remains to be done. At present, 15 to 30 liters of blood must be processed to secure enough haptens to desensitize one patient. Phillpot has suggested the use of methionine, 5 grams daily, throughout pregnancy for its protective influence on the fetal liver, the organ chiefly affected. This may be of value, but definite conclusions cannot be drawn from the few cases so far reported.

As far as transfusion is concerned, the clinical implication is clear. Rh typing should be routine, and no Rh negative person, male or female, should receive Rh positive blood. If this has been done, either in the days before the Rh factor was known, or in case of great urgency, that patient should under no circumstances be transfused again with Rh positive blood. The risk of a fatal reaction would be too great.

In obstetrical practice the Rh type of every pregnant woman should be determined early. If she is Rh negative and has had a transfusion, the Rh type of the transfused blood should be ascertained if possible. Also, the Rh

status of her husband and of other children (if any) should be determined. If she is a multigravida, or if she is a primigravida with a history of transfusion, tests for antibodies should be done at monthly intervals after the fifth month, and if present, titers should be noted. In such a case the prognosis for the child should be guarded, especially if the titer is rising; a rising titer of blocking antibodies is considered particularly grave. We cannot be too dogmatic, however, for we have all had the experience of delivering perfectly normal Rh negative babies under such conditions.

The termination of pregnancy 3 or 4 weeks before term by cesarean section or by induction of labor has not given satisfactory results in our hands, or in the experience of others. The babies are either severely damaged already, or they are in good condition. In either instance, the hazard of prematurity is an added risk.

After delivery, the Rh type of the baby and a study of its blood should be performed at once. If the baby is Rh positive, and is jaundiced or anemic with an abnormally high percentage of erythroblasts, transfusion with Rh negative blood should be performed at once. The same is true if the baby is Rh negative, and the clinical picture is that of hemolytic disease. In such a case, the true Rh type may be masked by the presence of antibodies, or the trouble may be caused by another type of sensitization. If the baby appears normal, it should be very closely observed clinically, and with hourly blood studies, and transfused as soon as any abnormal developments are noted. We prefer the replacement transfusion, using the umbilical vein if done soon after birth, the femoral if done later. The long plastic catheters of Diamond are employed, injecting 30 cubic centimeters at a time, then withdrawing 30 cubic centimeters, injecting and withdrawing again, and continuing this until 350 to 500 cubic centimeters of blood have been used. We consider this preferable to the use of repeated small transfusions; however, these have been used successfully in many cases.

It is important to discuss the situation frankly with the parents. One should not be overly optimistic or unduly pessimistic. As yet we do not know enough to be dogmatic in our statements. E. L. KING.

ACUTE FULMINATING CHOLECYSTITIS

NOT many decades have passed since the surgeon, faced with the problem of acute fulminating cholecystitis, thought only of the establishment of a vent to the outside world through which the distended gall bladder could empty. It was quite likely that, on account of inadequate anesthesia and other factors, an all-important stone in the cystic duct, or a large one impacted in the ampulla, might be left in place, and that the fistula of the cholecystostomy would fail to close. Over the years general advances in surgery, and a better understanding of the nature of acute cholecystitis, have led to the general acceptance of prompt cholecystectomy as the procedure of choice in the average case. Twenty years ago it was the custom to let acutely inflamed gall bladders "cool off," and to wait a few days after the patient's temperature reached normal before proceeding with surgery. In many instances the process advanced to perforation instead of subsiding. In addition, it was found that operation was likely to be technically much easier early in the acute phase than it would be ten days later. Endless arguments ensued between surgeons who advocated "immediate" operation and those who considered this unwise. Much of the difference of opinion was

due to the loose use of terms and misunderstanding as to just what "early" or "immediate" meant, in relation to the onset of the attack, or to the patient's admission to the hospital.

Acute cholecystitis is a dramatic disease and the appearance of the gall bladder at operation may be alarming indeed, with the huge thick red viscus often extending well down into the right lower quadrant or well out toward the flank. Fortunately, the pathology is usually not as ominous as it looks. Real empyema is the exception rather than the rule. Stones are almost invariably present, and distention of the gall bladder follows obstruction. The vascular factor then becomes important, with interference with the cystic vein and then the artery. The bacterial factor may be relatively in the background for some time. The omentum is a great shield against free perforation but perforation occurs often enough to present a real hazard. For some unknown reason acute cholecystitis seems to be commoner in males. The more treacherous and rapidly progressing type is apt to be encountered in the older age groups.

There seems not the slightest doubt that the swing of the pendulum to prompt cholecystectomy in these patients represents real progress and a very fortunate trend. However, those who are teaching young surgeons have the responsibility of pointing out repeatedly that there is still a definite place for cholecystostomy in the management of certain cases. Removal of an acutely inflamed gall bladder may be surprisingly simple and easy. On the other hand, engorgement, distortion, or friability may preclude the careful and complete demonstration of structures that is so essential to performance of a safe cholecystectomy.

Just as it is wise in occasional cases of appendicitis with abscess merely to establish drainage and to leave the removal of the appendix to a future date, so is it wise in certain cases of fulminating cholecystitis to limit the surgery to a careful cholecystostomy. One should never be ashamed when confessing this conservative decision to the patient or the family. If great care is taken to empty the gall bladder completely and external bile drainage appears promptly a most encouraging proportion of these patients remain well indefinitely after cholecystostomy.

If one is reasonably sure, at operation, that cholecystectomy can be safely accomplished it is surely the procedure of choice. In all other instances (probably 15 to 20 per cent) cholecystostomy should be resorted to. The decision must be made promptly and not *after* getting into serious technical difficulties. They are likely to be the sort of difficulties that are very hard indeed to get out of.

HOWARD PATTERSON.

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THE BOOK SHELF

THE BIRTH OF AN EMPEROR

RUDOLPH MARX, M.D., F.A.C.S., Los Angeles, California

IN the Crown Prince's Palace at Berlin on the night of January 26, 1859, there was hushed excitement. Victoria Louise, daughter of Queen Victoria of England and wife of the Crown Prince of Prussia, was expecting her first child—the heir apparent of Prussia.

The large chamber of the Crown Princess was being used as the delivery room according to the custom of the times. In a corner an old maidservant tended a wood fire in a large white porcelain stove. Outside an icy blizzard drove large flakes of snow across the Avenue, Unter den Linden. Again and again the shrieking storm, muffled by the heavy window curtains, pierced the stillness of the room and made the timid little flames of the candles shiver in their glass chimneys on the wall. Their soft reflections danced in the glass of several small pictures whose gay colors tried vainly to brighten the austerity of the high walls. These were water colors painted by the talented young princess herself. Pathetically incongruous they looked amidst the heavy draperies and carved furniture of the room—a futile attempt of the English girl to introduce a personal note into the frigid formality of her surroundings.

Beneath the heavy coverings of a huge canopied four-poster bed lay Victoria, almost hidden, a slender girl with blond hair and gray-blue eyes, a fine, slightly upturned nose and proud lips. No utterance of pain showed that she was in labor. With the self-control inculcated from childhood, she was bearing up silently as the relentless waves of pain passed through her body.

In a heavy armchair at the bedside sat the doctor, Professor Martin, the famous chief of the school of midwifery at the Hospital Charité of Berlin. The prototype of the doctor of his day, he was about forty, wore sidewhiskers and frock coat, and had brown hair thinning at the temples. Early that morning he had arrived at the palace with his staff of doctors, midwives, and nurses. Now he sat motionless, his keen gray eyes under a deep frown of worry fixed on the expectant mother.

Only once before this day had he been permitted to examine the Crown Princess, and then only through her heavy clothing. Upon his arrival at the palace in the morning he had made a thorough examination—the findings had confirmed his worst suspicions. The position of the infant was abnormal. Instead of the head, the buttocks were poised above the pelvis. This complication, known as breech presentation, happened about once in thirty births, and was fraught with danger. Especially in a firstborn.

The doctor had tried to correct the wrong position by external version, the procedure which he had been one of the first to describe in medical literature. He had attempted to turn the infant in the womb by deep manipulation from the outside. The doctor's skilled hands, feeling the contour of the child through the abdomen, tried to shove the trunk of the baby to one side and up, at the same time pushing the head down into its proper place in the pelvis.

To relax the tense muscles of the patient, the doctor had even employed chloroform, which had been in use as an anesthetic for only ten years. But all his efforts had been in vain. The infant was apparently too large to be turned, its head too big to be accommodated in the pelvis of the small mother. During the anesthesia the doctor had also found that the birth canal had not yet widened enough to permit a manual extraction of the child.

All day long and into the night, unable to do anything further, the doctor had sat at the bedside of the princess, anxiously waiting upon the intolerably slow natural progress. He could not even relieve the travail of the expectant mother by continuing the anesthetic. The danger of chloroform for mother and child when kept up for

Ewing Galloway, N.Y.

Birthplace of Wilhelm II of Germany—Crown Prince Palace, Unter den Linden, Berlin

a longer period was already known, as was also its paralyzing effect upon the spontaneous progress of labor.

As the night wore on the labor pains became more frequent and severe. Finally the girl of eighteen, who had borne up for so many hours with heroic self-control, broke down. Her lips quivered, tears filled her eyes, and like any girl of her age, she cried for her mother. But the devoted mother, Queen Victoria of England, for reasons of State, could not be present. In her stead she had sent the girl's old governess to act as faithful companion and first lady-in-waiting. This little English baroness now leaned over the bed and stroked the young girl's cheek, murmuring tender words with restrained affection.

Suddenly a rustling was heard in the anteroom. Princess Augusta, wife of the Prince Regent and mother of the Crown Prince, was approaching. As she entered the room, followed by her lady-in-waiting, everyone rose and bowed.

The older princess leaned over the girl in the bed and spoke to her gently. Then she turned to the doctor and motioned him aside. In low tones the doctor told her the result of his examination and explained the difficulties and dangers of the confinement. The only good word he could bring was the fact that his findings had revealed the baby to be a boy. Excitedly the old princess hurried out to carry the good and the bad news to her son, the blond young giant, Frederic Wilhelm of Hohenzollern, who like any other prospective father, was pacing the floor outside the room.

In a dark corner at the head of the bed, tall and motionless, stood the second lady-in-waiting, an old Prussian countess. Her black gown melted into the shadows of the heavy plush curtains on the canopied bed. Only her sharp white profile was visible in the dim light. With aquiline nose, jutting chin and stern mouth, she looked like a painting of one of her Crusader ancestors. She was of the oldest and proudest nobility of Prussia. The founder of her family, a famous Teutonic knight, had wrested the wilderness of East Prussia from the native Slavs in many a bloody battle.

Like other members of the old nobility of East Prussia, the countess looked with secret disdain upon the Hohenzollerns as newcomers and upstarts. Whereas the Teutonic knights had lived and died in Prussia since the 12th Century, the

Hohenzollerns, of undistinguished South German nobility, had not appeared until the 15th Century in Brandenburg. They had only acquired East Prussia in the 17th Century in a marriage bargain.

Now these new masters had given the Prussian nobility fresh cause for resentment. They had ignored the noble families of their own country and chosen a foreign bride for their Crown Prince.

The old countess had been watching the proceedings in the room all day with no sign of emotion. Her ears, sharpened by a lifetime of listening to the whispers of the Court, had overheard the low conversation between the doctor and the old princess.

Now she stepped forward and motioned the English baroness aside. Gravely she inquired if the baroness had heard the professor's bad news? Now she understood the dark rumors that had reached the palace from the royal court. The ghost of the "white lady" had been last night seen in the old palace at Potsdam. This apparition forbode evil to the house of Hohenzollern. The face of the little Englishwoman grew pale with anger and indignation.

"Spare me your silly superstitions and old fairy tales! You like to believe them because you hate us and wish us ill."

In a cold voice the countess answered, "But I tell you that they are not fairy tales. It is an evil omen for a child to be born breech first. Man is ordained to come into the world with his head leading. Creatures who enter the world by their extremities are possessed of base instincts."

With a gesture toward the bed the baroness tried to hush her, but the old Prussian woman would not be silenced. "Children brought forth by their feet are cursed—they are born as monsters, crippled in mind and body, and destined to bring misfortune into the world. It would be better if they were not born." Anxiously the Englishwoman searched the face of Victoria Louise, but the expectant mother, absorbed by her all-important task, was oblivious to everything outside of her.

The doctor looked up startled as snatches of the conversation reached his ears. His eyes met the cold gaze of the tall lady in black as she slowly retired into the dark corner. The doctor was well aware of the popular superstition that had survived since the Dark Ages about babies born feet first. Such children were believed to be possessed of the devil. And only too well did he know the facts on which the superstition was based. He could not help pondering the perils which this infant was facing during its journey into the world. He knew that almost one-third of firstborns delivered in this way were doomed to die. Of the remainder, many were crippled during birth and frequently in later life showed consequences of injury suffered during birth.

Reflecting on these dark prospects the doctor felt like a doomed man as he sat helplessly at the bedside. His was the superhuman task of solving a problem at which nature seemed to be failing. Put into his human hands was the fate of the heir of the great dynasty of the Hohenzollerns. How could a mere mortal bear the crushing burden of so great a responsibility? A silent prayer moved his lips.

The head midwife who had been listening to the heart sounds of the infant through the primitive wooden stethoscope, now motioned to the doctor. He took the stethoscope and listened. Under the continuous pressure of labor, the heart sounds of the child had become irregular—a signal of distress. The doctor checked the progress of labor and found that even after so many hours, the birth canal was still not dilated enough to allow a safe manual extraction of the child. But the ominous change of the infantile heart sounds left him no choice. There was no time to be lost if the child was to be saved. Hurriedly he consulted with his assistants and ordered everything to be made ready for an immediate manual delivery.

The first assistant started to drop chloroform on a mask covering the nose and mouth of the princess. The doctor and second assistant removed their frockcoats and turned up their shirt sleeves. A nurse tied aprons on them and they gave their hands a cursory wash, drying them on linen towels. Pasteur and Lister had not yet made their discoveries and the science of antisepsis was not born. The narcotized woman was placed on a marble table covered with sheets. The assistant administered the chloroform cautiously, drop by drop, aware of the narrow margin between the sleep-producing and the lethal dosage. The princess was still moving in her sleep as the doctor started his work of extracting the child.

He felt a leg and pulled on it. The left foot appeared. He succeeded in freeing the second leg without difficulty. Now he drew steadily on both legs and soon the slippery trunk emerged, the navel became visible. Quickly he loosened the tightened cord which carried the life-giving oxygen from mother to infant.

The real danger was now at hand. As the shoulder blades began to emerge, the head which followed began to encroach upon the cord, shutting off the circulation to the child. The doctor glanced at the clock on the wall impersonally ticking off the seconds. If the infant was to be born un-

harmed, the doctor knew that he must complete the delivery within the next eight minutes. The brain would not be able to withstand the lack of oxygen longer without risk of permanent damage or even death.

The doctor was breathing heavily as he looked anxiously at the clock again and again. Perspiration dripped down his face and collected in drops upon his whiskers.

Now a further complication arose. During the extraction of the baby the arms had been pulled upward about the head, further reducing the narrow space within the pelvic cavity. The arms must first be freed before he would be able to draw the head through the funnel-shaped pelvis.

With some difficulty he released the right arm and pulled it down. Then his fingers searched for the left arm. To his consternation he found it caught in the nape of the neck and wedged in the pelvis. He attempted to free the arm by pushing back and rotating the infant. The arm did not budge. Frantically he looked at the clock. Six minutes had passed.

He tried again and again to free the stubborn left arm. The clock ticked on. Eight minutes were gone. Desperation gripped the unfortunate doctor. Here within his grasp was the heir to the Hohenzollerns, and it was suffocating before his eyes.

Grimly he hooked his right index finger in the crotch of the left arm and pulled with all his might. The dull, wooden sound of cracking bone sickened him—and the limp left arm fell out. Now by steady pulling, assisted by the midwife pushing from above, he succeeded at last in bringing forth the head of the infant.

The whole procedure had taken ten minutes. Hurriedly he cut and tied the cord and handed the limp blue baby boy to the midwife who carried it to another table prepared for the care of the newborn.

Pale and exhausted, the doctor staggered over and listened to the infant's heart. It was beating feverishly with scarcely perceptible sounds. But the child was not breathing. The dark blue color of the skin was changing from second to second into the paler hue of death. The midwife started artificial respiration, rhythmically compressing and releasing the tiny chest. This brought momentarily a pinkish tinge to the baby's skin. But as soon as she stopped it turned blue again. The asphyxiated nerve centers were not yet able to animate the lungs. Every method known to science was used to revive the infant; stimulation of the skin with cold and warm water, swinging the child, but each time the external stimulation was discontinued, the lungs stopped breathing.

The greater part of an hour had passed since the birth. The infant's heart was still beating, not giving up its frantic struggle to live. In the excitement of trying to save the heir to the Prussian throne, the young mother had been almost forgotten. Lying in shock, she was unconscious of everything happening about her and seemed willing to share the fate of her firstborn.

Timidly the second midwife, a young peasant, came forward and suggested a method of resuscitation she had seen used in her village: the oldest and until today the most efficient method—mouth to mouth breathing, blowing the breath of the living into a lifeless body. The desperate doctor consented, and the young peasant girl placed her mouth to the mouth of the princeling and started rhythmically to exhale and inhale. The baby boy's color began to pinken. The legs twitched. After awhile the girl paused. All eyes were fixed on the infant. Then a miracle happened. The baby continued to breathe, filling its lungs with sufficient air to emit the complaining wail of the newborn, the first spontaneous expression of life.

The baby's first cry aroused the young mother from her deathlike slumber. And in another moment the silence of the room was broken by an outburst of joy. Doctors, nurses, and ladies of the Court were crowding around the baby, smiling, laughing, and shaking hands, as the first dim light of the morning of January 27 streaked into the room. No one paid attention to the limp left arm of the baby boy. Weeks passed before the doctors recognized that not only had the bone of the left upper arm been broken, but the nerve trunks had been injured as well. And it was years before the suspicion arose that the brain of the child had been damaged.

The infant born was Prince Wilhelm of Hohenzollern, later Emperor Wilhelm II of Germany.

REVIEWS OF NEW BOOKS

THE volume *Conditioned Reflexes and Neuron Organization*,[1] by a Polish neurophysiologist working in England, is essentially a criticism of the Pavlovian theories and a rejection of them as being fundamentally unsound.

It is the opinion of the author that the Pavlov school's explanation of nervous processes is totally different from that of Sherrington, and that it constitutes a separate and independent line of inquiry. The author bases all his conceptions of higher nervous activity on the neuronic theory, and though he is aware of much of the newer information concerning the rhythmic electrical activity of the brain, he feels that eventually the Sherrington concept of total nervous activity will adequately encompass the entire problem. It is his purpose in this book to extend the Sherrington theories of the total physiology of the nervous system, and at the same time to elucidate the fallacies of Pavlov. He was a pupil of Pavlov, but has rejected Pavlov's theories as actually incorrect and not adequate even for a working hypothesis in the light of experimental facts. It is the author's opinion "that study of the physiology of higher nervous activity is so complex and difficult that, if anyone formulated a system of working hypotheses which completely accorded with the factual evidence and were not internally contradictory, we should be prepared to accept that system . . ."

The book does not present any new *facts*, but sticks to its purpose which is one of critique. The bibliography is largely Russian and Polish.

JOHN MARTIN.

IN rereading Dr. Walter C. Alvarez' *An Introduction to Gastro-Enterology*[2] I have thought that few modern medical writers were so well equipped as he to write such an extensive guide to gastroenterological literature and research. George Santyana has said, "Few have much time to read originals and to study facts. Leaders and busybodies must obey their momentum." Dr. Alvarez is a leader in medical thought but thanks to the Foundation of the Mayo Clinic has a wonderful opportunity to read and digest the gastroenterological literature. Those of us in the practice of medicine cannot but envy a man who has the time, energy, and ability to review and accept or reject the vast amount of material which this book embraces.

One does not like to write a review by saying the only thing for the reader to do is to read the book for himself; but it is almost impossible to point out all the meaty facts presented. Alvarez devotes considerable space to the effects of vagotomy, because of the present day interest in the Dragstedt operation. He has added also to the chapters on the "pylorus, the nerves running to the bowel, the nerves of the gallbladder, the functions of the colon, flatulence, electro-enterograms, and technical methods and apparatus."

This is not a clinical treatise of the scope of the 3 volumes by Bockus, but rather an application of the physiology of the gastrointestinal tract to the practice of medicine. It emphasizes fundamental principles and research that may be of the greatest importance in giving the clinician or research worker an idea such as that which started Banting on the search for insulin. For, while a great deal of laborious laboratory and clinical work has been done (there is still the quest for the Holy Grail), the problems have not always been well chosen.

While we read the book for information, we cannot but be impressed by Alvarez' simple running flow of comment. His style is unique and delightful.

The book is extremely important to all doctors because of the wealth of material on gastroenterology collected here. It is of equal help to busy practitioners without time to read the entire book because of the adequate summary of information at the end of each chapter. The book is a superb achievement and immensely informative. ARTHUR J. ATKINSON.

THE sixth edition of *Emergency Surgery*[3] by Hamilton Bailey is to be issued in 5 separately bound parts. This review covers the first 2 parts which are now available.

Part 1 contains 180 pages divided into 19 chapters. The first 4 chapters are devoted chiefly to the technique of fluid administration, including the preparation and storage of blood and plasma. The author is much impressed with the sternal route for rapid replacement of blood or plasma when the need arises.

Chapter 5 covers the treatment of shock, and there is little with which the reader might take issue.

Chapter 6 is devoted to the selection and administration of anesthesia for urgent operations, with particular emphasis on the value of local, spinal, and intravenous methods used alone or in combination. Chapter 7 on "Impending Death under Anesthesia" reviews the methods for the treatment of blue (respiratory) asphyxia and white (cardiac) asphyxia with indications and technique for direct cardiac massage.

Chapter 8 on armamentarium is a short 7 page enumeration of the general types of instruments required for emergency surgery. This is followed by Chapter 9 which describes the technical details of

[1] CONDITIONED REFLEXES AND NEURON ORGANIZATION. By Jerzy Konorski. Translated from the Polish ms. under the author's supervision by Stephen Garry. Cambridge, at the University Press; New York: The Macmillan Co., 1948.

[2] AN INTRODUCTION TO GASTRO-ENTEROLOGY. By Walter C. Alvarez. 4th ed. New York: Paul B. Hoeber, Inc.. 1948.

[3] EMERGENCY SURGERY. Parts 1 and 2. By Hamilton Bailey, F.R.C.S. (Eng.), F.A.C.S., F.I.C.S., F.R.S.E. 6th ed. Baltimore: The Williams & Wilkins Co., 1948.

opening and closing the abdomen by various incisional approaches.

Chapter 10 is devoted to the management of postoperative evisceration.

Chapter 11 describes the more common lesions which may affect the abdominal wall and extraperitoneal tissues.

Chapter 12 is an excellent guide for the inexperienced surgeon regarding the utilization of drainage.

Chapter 13 reviews the principles concerned in the treatment of diffuse peritonitis of obscure origin and is followed by 2 chapters on the management of acute appendicitis and its complications. Many will take issue with the incision recommended for drainage of appendiceal abscess placed at right angles to the customary McBurney incision.

Chapters 16 and 17 discuss the differentiation and management of acute salpingitis and other conditions simulating acute appendicitis.

Chapter 18 describes in detail nonoperative methods for gastric, duodenal and intestinal decompression; and is followed by a short chapter reviewing the indications and technique for establishment of an enterostomy.

Part 2 of *Emergency Surgery* contains chapters 20 through 37 and includes 207 pages.

Chapters 20 and 21 describe the management of perforated gastric and duodenal ulcers, of bleeding ulcer, and of other causes of hematemesis and melena. Chapter 22 concludes the discussion of the stomach with a short review of acute dilatation, complications of gastric surgery and congenital lesions of the stomach.

Chapter 23 is devoted to the common surgical lesions of the gall bladder and bile ducts. The ease with which the author is content to differentiate obstructive from toxic jaundice by the glucose tolerance test might be questioned by many surgeons. The inexperienced reader might benefit from a more detailed evaluation of the proper time for removal of common duct tubes.

Chapter 24 on acute pancreatitis makes little reference to the diagnostic value of the amylase or diastase determination, but covers the treatment of this condition in a very satisfactory manner.

Chapter 25 discusses the management of such miscellaneous abdominal conditions as subphrenic abscess, pylephlebitis, intraperitoneal rupture of hydatid cyst, and the recognition of abdominal crises of pernicious anemia.

Chapter 26 is devoted to the management of patients who have ingested foreign bodies.

Chapter 27 describes the treatment of patients with the more common intra-abdominal injuries, including rupture of the spleen or liver, lacerations of the mesentery, injuries to the pancreas, gall bladder, and bile ducts, and rupture of the intestine. This is followed by a chapter on the management of penetrating wounds of the abdomen and abdominothoracic injuries.

Chapter 29 describes in detail methods of intestinal resection and anastomosis. It is doubtful whether the telescoping method for end-to-end anastomosis warrants the enthusiasm afforded it.

Chapters 30 through 37 review the common causes of intestinal obstruction in both infants and adults, and their management.

These volumes represent an excellent and comprehensive review of the problems of emergency surgery by an exceptionally well qualified author.

The reader may be slightly antagonized by the frequent use of the first person and constant reference to the successful accomplishments of the author; however, if one will bear in mind the tremendous experience and established ability of the author, this feature becomes only a minor annoyance. The multitude and excellence of the illustrations leave no questions in the mind of him who seeks advice from these books. The figures average nearly 2 to each page, they are sharp and distinct, and many are in color or tinted. In the opinion of the reviewer, this is a most valuable guide book for the resident surgeon and for those who must perform either emergency or elective surgery without benefit of extensive training or experience. To them, these volumes will give a real helping hand in a time of need.

EDWARD W. GIBBS.

THE third edition of the *Histopathology of the Peripheral and Central Nervous Systems*[1] has been considerably enlarged and is illustrated by 302 excellent figures, most of them photographs from the author's own collection. The division of the text into the 3 main chapters on diseases of the peripheral nerves, the spinal cord, and the brain is well suited as an aid to the clinical teaching of neurology, though this leads, of necessity, to repetitions when it comes to the description of the different neuropathologic manifestations.

The book testifies to the author's encyclopedic knowledge of the neuropathologic literature. One has to appreciate the clarity with which controversial theories are cited and due credit is given to other authors. Of course, the author emphasizes his own theories though they may be opposed to other prevalent present day teaching. One wonders whether it might not have been wiser to accept some of the more modern, well established concepts, e.g. to change the idea that "the Virchow Robin spaces occupy the space between muscularis and adventitia" or that "the choroid plexus of the brain has nothing to do with the production of the cerebrospinal fluid" though others have demonstrated such secretion by injecting fluorescent dyes intravenously and observing them escaping from the choroid plexus of experimental animals.

But such minor criticisms should not deter one from acknowledging the value of this textbook which has successfully guided several generations of neurologists in their study of neuropathology. The readers of this journal should be especially interested in the

[1] HISTOPATHOLOGY OF THE PERIPHERAL AND CENTRAL NERVOUS SYSTEMS. By George B. Hassin, M.D. 3rd rev. enl. ed. Chicago: The Author, 1948.

chapters on diseases of the muscles and of the peripheral nerves which are well represented.

ARTHUR WEIL.

THE second edition of *Clinical Urology*[1] by Lowrain E. McCrea, offers a concise kaleidoscopic picture of clinical urology for general practitioners, interns, and medical students. It consists of 503 pages, is well illustrated and the printing is very easy to read.

The author advises against all simultaneous bilateral retrograde pyelograms, but it seems to us there is very little basis for such teaching.

The treatment of sulfonamide anuria is described as excess hydration of the patient. The question of fluid exchange in such conditions is still a moot question. Many excellent clinicians believe these patients are drowned by excessive hydration.

The author should be congratulated for including a very adequate section on gonorrheal urethritis and its complications. It is refreshing to know that there are workers who realize that the genital adnexa must be checked before a gonorrheal urethritis can be pronounced cured.

It is suggested that the section of the book which deals with the so called neurogenic bladder should include a statement concerning the transurethral revision of the vesical neck in certain of these patients.

A second edition of such a book is very commendable. The progress of medicine makes re-editions mandatory. This is valuable for general practitioners, who have so little time for extra reading. The author initiated this book for the sake of practicability. His original idea has been fulfilled. He has portrayed a simple, straightforward and logical story of urological disease and its treatment.

WILLIAM J. BAKER.

[1]CLINICAL UROLOGY; ESSENTIALS OF DIAGNOSIS AND TREATMENT. By Lowrain E. McCrea, M.D., F.A.C.S., F.I.C.S. 2d ed. Philadelphia: F. A. Davis Co., 1948.

BOOKS RECEIVED

Books received are acknowledged in this department, and such acknowledgment must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

MANUAL OF MEDICAL EMERGENCIES. By Stuart C. Cullen, M.D., and E. G. Gross, M.D. Chicago: The Year Book Publishers, Inc., 1949.

NEUE DEUTSCHE CHIRURGIE. (P. v. Bruns) 63rd vol. NOTFALLCHIRURGIE DIE AUSFÜHRUNG DER DRINGLICHEN BLUTIGEN EINGRIFFE. By Prof. Dr. Adolf Ritter. 2d rev. enl. ed. Stuttgart: Ferdinand Enke, 1949.

LA CHIRURGIE DU MOUVEMENT. By Raphaël Massart. Paris: G. Doin & Cie, 1949.

PLANNING, DESIGN AND PRODUCTION OF THE MODERN SCIENTIFIC BOOK. By Paul Perles. Brooklyn: George McKibbin & Son, 1949.

FEMALE SEX ENDOCRINOLOGY; CONCISE THERAPY. By Charles H. Birnberg, M.D. Philadelphia, London, and Montreal: J. B. Lippincott Co., 1949.

TONICS AND SEDATIVES. By Morris Fishbein, M.D. Philadelphia, London, Montreal: J. B. Lippincott Co., 1949.

FUNKTIONELLE PATHOLOGIE IN DER CHIRURGIE; CHIRURGIE UND VEGETATIVES SYSTEM; EINE EINFÜHRUNG IN DIE KORRELATIVE CHIRURGIE. By Dr. Christiaan van Gelderen. 2d rev. ed. Berlin, Göttinger, Heidelberg: Springer-Verlag, 1949.

SURFACE AND RADIOLOGICAL ANATOMY FOR STUDENTS AND GENERAL PRACTITIONERS. By A. B. Appleton, M.A., M.D. (Cantab.), W. J. Hamilton, M.D., D.Sc., F.R.S.E., and G. Simon, M.D., B.Ch., D.M.R.E. (Cantab.). 3d ed. Baltimore: The Williams & Wilkins Co., 1949.

ESSENTIALS OF ORTHOPAEDICS. By Philip Wiles, M.S. (Lond.), F.R.C.S. (Eng.), F.A.C.S. Philadelphia and Toronto: The Blakiston Co., 1949.

THE PRACTICE OF REFRACTION. By Sir Stewart Duke-Elder, K.C.V.O., M.A., B.S. (St. And.), Ph.D. (Lond.), M.D., F.R.C.S. Hon. B.Sc. (North Western). 5th ed. St. Louis: The C. V. Mosby Co., 1949.

ATLAS OF ROENTGENOGRAPHIC POSITIONS. By Vinita Merrill. Vols. 1 and 2. St. Louis: The C. V. Mosby Co., 1949.

ESTUDOS CIRÚRGICOS. By Eurico Branco Ribeiro. 5th série. São Paulo, Brasil: São Paulo Editôra S. A. imprimiu, 1949.

DIAGNOSTIC HORMONAL ET TRAITEMENTS HORMONAUX EN GYNÉCOLOGIE. By Claude Béclère. 2d ed. Paris, Masson et cie, 1949.

THE VALUE OF HORMONES IN GENERAL PRACTICE. By W. N. Kemp, M.D. Minneapolis: Burgess Publishing Co., 1949.

LEHRBUCH DER GYNÄKOLOGIE. By Prof. Dr. Med. Heinrich Martius. 2d rev. ed. Stuttgart: Georg Thieme Verlag, 1949.

CLINICAL CONGRESS OF AMERICAN COLLEGE OF SURGEONS

DALLAS B. PHEMISTER, Chicago, *President*
FREDERICK A. COLLER, Ann Arbor, *President-Elect*

PRELIMINARY PROGRAM FOR THE 35th CLINICAL CONGRESS—THE STEVENS, CHICAGO, OCTOBER 17 TO 21, 1949

TELEVISED operations in color will be one of the new features of the thirty-fifth Clinical Congress of the American College of Surgeons and the Sixth Inter-American Congress of Surgery which will be held from October 17 through 23 with headquarters at The Stevens in Chicago. The Inter-American Congress will meet concurrently with the Clinical Congress from October 17 to 21 and will continue in session two days longer. Many delegates and other surgeons from Latin-American countries are registering, along with their colleagues from the United States and Canada, with the anticipation of a seven-day surgical program of extremely great interest. More than the usual number of guests from other continents are also expected as a result of the holding of the thirteenth Congress of the International Society of Surgery in New Orleans the week preceding the two Chicago Congresses; many of the delegates to that meeting are planning to remain in this country to attend the Clinical Congress.

Every Fellow of the American College of Surgeons is a member of the Association of Inter-American Congresses of Surgery by virtue of the fact that the College is a signatory member of that organization. Its scientific and social sessions on Saturday and Sunday are therefore open to all Fellows. The members of the other signatory societies of the Association are likewise entitled to attend the Clinical Congress clinics and scientific meetings, since it is the practice for the host country to make a joint event of its own annual surgical Congress and that of the Inter-American group.

In making hotel reservations it is therefore well to bear in mind the seven-day extent of the Congresses. The program of the separate sessions of the Inter-American Congress is quite different in nature from that of the Clinical Congress and will offer an unusual opportunity to hear important surgical themes discussed from the standpoint of similarities and differences in methods of treatment in a number of countries. The Inter-American Congress of Surgery will undoubtedly enhance the international prestige of the American College of Surgeons and will familiarize North American Fellows and overseas guests with surgical progress in the other Americas.

Preliminary plans for the program of the Sixth Inter-American Congress of Surgery are described in a separate article which follows. The opening or inaugural session will be held on Friday morning, October 21. This session is for delegates and special guests only. The scientific sessions on Saturday and Sunday, and the official banquet on Saturday evening, will be open to all Fellows, whose presence will help to show how deeply interested the American College of Surgeons is in the cultivation of mutually beneficial professional and social relationships among surgeons throughout the Americas.

CLINICAL CONGRESS PROGRAM

A general assembly for both surgeons and hospital personnel on Monday morning, October 17, will be the opening session of the varied and comprehensive program of meetings which will be held at the headquarters hotel and nearby auditoriums. Scientific sessions, official meetings, hospital conferences, showings of medical motion pictures, telecasts, and exhibits will follow during the five days of the Clinical Congress. The special sessions of the Sixth Inter-American Congress of Surgery on Friday, Saturday, and Sunday, will, according to present plans, be held in the John B. Murphy Auditorium of the College. All registrants for both Congresses will be interested in the ex-

tensive display of technical and scientific exhibits in the exhibition hall on the lower level of the headquarters hotel.

CLINICS

Operative and nonoperative clinics will be held in some twenty hospitals in the Chicago area each day during the Clinical Congress. The hospitals which will participate in the clinical program, and which are listed later in this article, are approved by the American College of Surgeons for graduate training in surgery. The schedule of clinics, which will cover general surgery, obstetrics and gynecology, fractures and other traumas, orthopedic surgery, thoracic surgery, plastic surgery, neurosurgery, genitourinary surgery, and ophthalmology and otorhinolaryngology, will be published in a *Daily Clinical Bulletin* which will be issued each day during the Clinical Congress. The clinic schedules will also be posted on bulletin boards.

TELEVISION

Operations will be telecast, in color, to the hotel from St. Luke's Hospital at scheduled periods each day. The television program will be over a closed circuit, impossible to pick up on public sets. The operations and demonstrations will be transmitted to about twenty color transmission receivers in the hotel. The engineers anticipate excellent reception since the hospital is in a direct line of vision from the roof of The Stevens. The television will be sponsored by Smith, Kline & French Laboratories.

The successful demonstrations of television at the Clinical Congress in New York in 1947, and at the Clinical Congress in Los Angeles in 1948, make it highly desirable to continue the use of this medium. Even when limited to black and white images, as it was then, the surgeons were most enthusiastic. Color, demonstrated in televised surgery telecasts for the first time at the American Medical Association's convention in Atlantic City in June, greatly enhances the value of the telecasts.

Television has proved to be an ideal means of furthering the "Show me" purpose which was the main incentive for the founding of the Clinical Congress of Surgeons of North America in 1910, three years before the American College of Surgeons was organized. That first Clinical Congress was held in Chicago. The 1949 meeting will be the ninth held in that city.

PRESIDENTIAL MEETING

The Presidential Meeting will be held on Monday evening, October 17. The complete program appears on another page. At this meeting the officers-elect, consisting of Dr. Frederick A. Coller, of Ann Arbor, president, Dr. Donald G. Tollefson, of Los Angeles, first vice-president, and Dr. Robert M. Moore, of Galveston, second vice-president, will be installed. The outgoing president, Dr. Dallas B. Phemister, of Chicago, will preside and will deliver the Presidential Address. His subject will be, "An Evaluation of Full-time and Group Practice for the Clinical Faculty of a Medical School."

Sir James R. Learmonth, of Edinburgh, will deliver the fourth Martin Memorial Lecture. His subject will be "Collateral Circulations, Natural and Artificial."

CONVOCATION

The formal initiation ceremonies for the new Fellows will be a colorful feature of the annual Convocation which will be held on the final evening, Friday, October 21. Honorary fellowships will also be conferred on this occasion. Lord Webb-Johnson, of London, president of the Royal College of Surgeons of England, will deliver the Fellowship Address. His subject will be "Science in Surgery—Stop, and Look, and Listen."

GENERAL SURGERY

In general surgery, the program at the headquarters hotel will embrace three evening symposia and six afternoon panel discussions.

The subjects for the symposia on Tuesday, Wednesday, and Thursday evenings, respectively, will be: "Acute Surgical Emergencies in Gynecology and Obstetrics"; "Blood Coagulation and the Use of Anticoagulants"; and "Malignant Disease." At the Wednesday evening session there will also be presented the Fracture Oration by Dr. Otto J. Hermann, of Boston, on the subject "Fracture Hazards."

The following subjects have been chosen for the afternoon panel discussions in general surgery, the first one of which will be held from 1:30 to 3:00 and the second from 3:30 to 5:00 o'clock on Monday, Tuesday, and Wednesday: "Surgical Lesions of the Breast"; "Fractures of the Skull"; "Massive Upper Abdominal Hemorrhage"; "New Surgical Technics in Drug Treated Infections"; "The Management of Acute Emergencies Occurring during Operations"; and "Preoperative and Postoperative Care and Anesthesia for Infants."

Detailed programs appear on succeeding pages.

SURGICAL SPECIALTIES

Panel discussions for the surgical specialties will be held on Friday afternoon from 1:30 to 4:45

o'clock. The panels will be held concurrently in the following fields: orthopedic surgery, plastic surgery, urology, thoracic surgery, neurological surgery, and obstetrics and gynecology. Programs are shown on succeeding pages.

OPHTHALMOLOGY AND OTOLARYNGOLOGY

Separate programs for specialists in ophthalmology and otolaryngology are being planned, the details of which will be announced later. Operative clinics in these specialties in the hospitals will also be particularly emphasized this year.

SYMPOSIA ON AMPUTEES AND ON TRAUMA

A symposium on "The Care and Education of Amputees" will be held on Tuesday morning from 10:00 a.m. until noon. On Tuesday afternoon from 2:00 until 5:00 o'clock, a symposium on trauma will be held at which the following subjects will be discussed: "Plastic Surgical Repair of Radiation Injuries"; "Observations on Results of Shoulder Cuff Repair"; "Use of Intramedullary Fixation in Fractures"; "A Prolonged End Result Study of 235 Intracapsular Fractures of the Femoral Neck"; "An Analysis of the Management and Complications of Multiple (3 or more) Rib Fractures"; "Blood and Blood Substitutes in Trauma"; "Fractures of the Tarsal and Metatarsal Bones"; and "Reconstructive Surgery Following Trauma." Dr. Robert H. Kennedy, of New York, chairman of the Committee on Trauma, will preside at both sessions. The programs appear on succeeding pages.

SYMPOSIUM ON CANCER

A symposium on cancer will be held on Wednesday afternoon from 2:00 until 5:00 o'clock, with Dr. Grantley W. Taylor, of Boston, chairman of the Cancer Committee, presiding. The program appears on a succeeding page.

HOSPITAL CONFERENCES

The twenty-eighth Hospital Standardization Conference will be held during the first 4 days of the Clinical Congress. Its opening meeting will constitute the first formal session of the Clinical Congress and will be for both surgeons and hospital representatives. Dr. Dallas B. Phemister, president of the College, will preside.

Hospital administrators, trustees, members of medical staffs, nurses, technicians, dietitians, and heads of the various hospital departments and their personnel, are invited to participate in the discussions at the hospital conferences which will be directed by leading authorities in the hospital field in the United States and Canada. The program will include formal sessions, panel discussions, round table conferences, symposia, and forums. An outline of the program appears on a succeeding page.

FORUM ON FUNDAMENTAL SURGICAL PROBLEMS

The Forum on Fundamental Surgical Problems, one of the most popular features of Clinical Congresses during the past few years, will be held on Monday through Thursday afternoons, and Tuesday through Friday mornings. Two concurrent sessions will be held on Wednesday morning only. Brief reports of original clinical and experimental observations relating to the broad aspects of surgery and the surgical specialties will be presented under the general direction of Dr. Owen H. Wangensteen, chairman of the committee, Forum on Fundamental Surgical Problems. An outline of the main topics follows:

Monday, 2:00—5:00 p.m.—Gall Bladder and Pancreas; Urology; Orthopedics; Plastic Surgery
Tuesday, 9:00—12:00 a.m.—Surgery of the Heart
Tuesday, 2:00—5:00 p.m.—Vascular Surgery and Surgery of Hypertension
Wednesday, 9:00—12:00 a.m.—Neurosurgery
Wednesday, 9:00—12:00 a.m.—Thyroid, Lungs, Esophagus; Anesthesia
Wednesday, 2:00—5:00 p.m.—Stomach and Intestines
Thursday, 9:00—12:00 a.m.—Wounds and Wound Healing; Burns; Infections; Shock
Friday, 9:00—12:00 a.m.—Blood and Body Fluids; Portacaval Anastomosis; Cancer

The Thursday afternoon session, from 1:00 to 3:30, will be conducted as a seminar, with Dr. I. S. Ravdin as moderator, on the subject: "Nutritional Problems including a Consideration of the Use of Fluids and Electrolytes."

ASSEMBLY OF INITIATES

The 1949 initiates will attend an assembly on Friday afternoon from 1:45 to 2:30 o'clock. Dr. Frederick A. Coller, newly installed president of the College, will preside. Dr. Irvin Abell, chairman of the Board of Regents, and Dr. Bowman C. Crowell, Dr. Malcolm T. MacEachern, and Dr. H. Prather Saunders, associate directors, will present briefly an outline of the program of the College.

OTHER OFFICIAL MEETINGS

The annual meeting of the Governors and Fellows of the College will be held on Thursday afternoon at 3:30 o'clock. Reports on activities

of the American College of Surgeons, of great interest to all of its Fellows, will be presented by officers, chairmen, and administrative staff members, following the election of officers.

Four important committee meetings will be held on Wednesday as follows: State and Provincial Executive Committees, 10:00 to 11:00 a.m.; State and Provincial Credentials Committees and Committees on Applicants and Judiciary Committees, 11:00 a.m. to 12:00 noon; the Committee on Trauma and Regional Committees (formerly the Committee on Fractures and Other Traumas), 3:30 to 5:30 p.m.; and the annual dinner and meeting of the Cancer Committee, 6:30 p.m.

Thursday committee meetings will include a meeting of the Committee on the Library and the annual dinner meeting of the Committee on Trauma.

COMMITTEE ON ARRANGEMENTS AND EXECUTIVE COMMITTEE

The Chicago Committee on Arrangements and the Executive Committee for the Clinical Congress are actively at work on arrangements for the program. The membership of these committees follows:

Committee on Arrangements

Warren H. Cole, M.D., F.A.C.S., chairman
Lester R. Dragstedt, M.D., F.A.C.S. vice chairman
Michael L. Mason, M.D., F.A.C.S., secretary
Dallas B. Phemister, M.D., F.A.C.S., president and regent of the College
William E. Adams, M.D., F.A.C.S.
James J. Callahan, M.D., F.A.C.S.
Fremont A. Chandler, M.D., F.A.C.S.
Edward A. Christofferson, M.D., F.A.C.S.
Vernon C. David, M.D., F.A.C.S.
Loyal Davis, M.D., F.A.C.S.
M. Edward Davis, M.D., F.A.C.S.
Paul W. Greeley, M.D., F.A.C.S.
Paul H. Holinger, M.D., F.A.C.S.
Sumner L. Koch, M.D., F.A.C.S.
Herman L. Kretschmer, M.D., F.A.C.S.
Walter G. Maddock, M.D., F.A.C.S.
Foster L McMillan, M.D., F.A.C.S.
Karl A. Meyer, M.D., F.A.C.S.
Harry A. Oberhelman, M.D., F.A.C.S.
Willis J. Potts, M.D., F.A.C.S.
Charles B. Puestow, M.D., F.A.C.S.
Herbert E. Schmitz, M.D., F.A.C.S.
Derrick T. Vail, M.D., F.A.C.S.

Executive Committee

Warren H. Cole, M.D., chairman
Lester R. Dragstedt, M.D., vice chairman
Michael L. Mason, M.D., secretary
Dallas B. Phemister, M.D., president and regent of the College
James J. Callahan, M.D.
Loyal Davis, M.D.
Walter G. Maddock, M.D.

PARTICIPATING HOSPITALS AND HOSPITAL CLINICS COMMITTEE

Augustana Hospital: Oscar E. Nadeau, M.D., F.A.C.S.
Children's Memorial Hospital: Paul F. Fox, M.D., F.A.C.S.
Cook County Hospital: Manuel E. Lichtenstein, M.D., F.A.C.S.
Evanston Memorial Hospital: J. Edward Kearns, Jr., M.D., F.A.C.S.
Illinois Eye and Ear Infirmary: Maurice D. Pearlman, M.D.
Lewis Memorial Maternity Hospital: Herbert E. Schmitz, M.D., F.A.C.S.
Mercy Hospital-Loyola University Clinics: John B. O'Donoghue, M.D., F.A.C.S.
Michael Reese Hospital: Morris L. Parker, M.D., F.A.C.S.
Mount Sinai Hospital: David A. Willis, M.D., F.A.C.S.
Passavant Memorial Hospital: Walter W. Carroll, M.D., F.A.C.S.
Presbyterian Hospital: Francis H. Straus, M.D., F.A.C.S.
Provident Hospital: Ulysses Grant Dailey, M.D., F.A.C.S.
St. Elizabeth's Hospital: Martin Girard Luken, M.D., F.A.C.S.
St. Joseph Hospital: Leonard Kratz, M.D., F.A.C.S.
St. Luke's Hospital: Foster L. McMillan, M.D., F.A.C.S. Assistant: John T. Reynolds, M.D., F.A.C.S.
St. Mary of Nazareth Hospital: Anthony S. Sampolinski, M.D., F.A.C.S.
University of Chicago Clinics
  Albert Merritt Billings Hospital: J. Garrott Allen, M.D., F.A.C.S.
  Bobs Roberts Memorial Hospital for Children: J. Garrott Allen, M.D., F.A.C.S.
  Chicago Lying-in Hospital and Dispensary: William Dreckmann, M.D.
  Home for Destitute Crippled Children: J. Garrott Allen, M.D., F.A.C.S.
University of Illinois Hospitals: John T. Reynolds, M.D., F.A.C.S.
Wesley Memorial Hospital: Earl O. Latimer, M.D., F.A.C.S.
Hines Veterans Administration Hospital: Charles B. Puestow, M.D., F.A.C.S. Assistant: James H. Cross, M.D., F.A.C.S.

SPECIAL COMMITTEE ON TELEVISION

Foster L. McMillan, M.D., F.A.C.S., St. Luke's Hospital, Chairman
Burton C. Kilbourne, M.D.
Charles E. Shannon, M.D., F.A.C.S.

GENERAL AND PROGRAM COMMITTEES

The Clinical Congress general committee which operates under the Administrative Board of the College, consists of Dr. Malcolm T. MacEachern, chairman, Miss Eleanor K. Grimm, secretary, Doctors Bowman C. Crowell, Charles F. Branch, George H. Miller and H. Prather Saunders, and Mr. Edward G. Sandrok, Mr. James S. Shannon, and Miss Laura G. Jackson. The Clinical Congress Committee on Program consists of Dr. Frederick A. Coller, chairman, and Doctors Henry W. Cave, Evarts A. Graham, and Alton Ochsner.

The Advisory Committee on Programs consists of Dr. George H. Miller, chairman, and Doctors Warren H. Cole, Sumner L. Koch, Michael L. Mason, Charles B. Puestow, Bowman C. Crowell, H. Prather Saunders, Charles F. Branch, and Malcolm T. MacEachern.

MEDICAL MOTION PICTURES

The showing of medical motion pictures each day will again be a popular feature of the Clinical Congress. The latest available films on surgery and related subjects will be presented. Special showings will be arranged of medical motion pictures in the fields of ophthalmology and otorhinolaryngology. Both sound and silent films will be shown, all of which will have been approved by the Committee on Motion Pictures.

Some of the newer medical motion pictures which have been or are being produced under Directing Committees of the College, will be presented during the Clinical Congress. Among these will be the film entitled "Injuries of the Peripheral Nerves" directed by Dr. Loyal Davis, under a grant from the Johnson & Johnson Research Foundation. A première showing of this particular film will take place in the Murphy Memorial Auditorium of the College at the time of the Congress in October.

TECHNICAL AND EDUCATIONAL EXHIBITION

The Technical and Educational Exhibits will be held in the Exhibition Hall on the lower level of The Stevens. There will be represented leading manufacturers of surgical instruments, of x-ray apparatus, of sterilizers, of operating room lights, of ligatures, of dressings, of hospital apparatus and supplies of all kinds, and of pharmaceuticals, and publishers of medical books.

There will also be presented exhibits depicting the work of the College.

ADVANCE REGISTRATION

Surgeons who wish to attend the Congress should register in advance. Advance registration will greatly expedite the procedure of registering. No registration fee will be charged Fellows whose dues are paid to December 31, 1948. For endorsed Junior and Senior Candidates, the fee will be $5.00. Non-Fellows who after individual consideration are permitted to register, will pay a fee of $10.00. No registration fee will be required of initiates of the class of 1949.

HOTEL RESERVATIONS

It is desirable to make hotel reservations as early as possible. In making these, communications should be addressed to the Convention Housing Bureau, 105 West Madison Street, Chicago, stating that you will be attending the Clinical Congress of the American College of Surgeons. All hotel reservations, both for surgeons and hospital representatives, are to clear through this Bureau. No correspondence should be sent directly to the hotels. A form for reservations was recently sent to Fellows.

A list of the principal participating hotels and minimum rates follows:

Chicago Hotels	Single	Double
Atlantic	$3.50	$5.00
Bismarck	5.00	8.00
Brevoort	3.50	6.00
Chicagoan	3.75	5.50
Drake	4.50	7.50
Eastgate	3.50	5.50
Hamilton	4.00	6.00
Harrison	3.00	4.00
Knickerbocker	5.00	8.00
Maryland	4.00	6.00
Midland	3.00	4.50
Palmer House	4.00	8.00
Sheraton	3.85	6.40
Stevens	4.50	7.00

PRELIMINARY PROGRAM

PRESIDENTIAL MEETING

Monday, 8:15-10:30 p.m.—Ballroom, The Stevens

DALLAS B. PHEMISTER, M.D., F.A.C.S., Chicago; president, American College of Surgeons, presiding.

Processional—Officers, Regents, and Distinguished Guests.

Invocation.

Address of Welcome. WARREN H. COLE, M.D., F.A.C.S., Chicago; chairman, Committee on Arrangements.

Introduction of Distinguished Guests. ARTHUR W. ALLEN, M.D., F.A.C.S., Boston; vice chairman, Board of Regents.

Address of the Retiring President: An Evaluation of Full-time and Group Practice for the Clinical Faculty of a Medical School. DALLAS B. PHEMISTER, M.D.

Inauguration of Officers:

Presented by HOWARD A. PATTERSON, M.D., F.A.C.S., retiring first vice president.

First vice president: DONALD G. TOLLEFSON, M.D., F.A.C.S., Los Angeles.

Second vice president: ROBERT M. MOORE, M.D., F.A.C.S., Galveston.

President: FREDERICK A. COLLER, M.D., F.A.C.S., Ann Arbor.

The Fourth Martin Memorial Lecture: Collateral Circulations, Natural and Artificial.

SIR JAMES R. LEARMONTH, M.B., Ch.M., F.R.C.S. (Ed.), Edinburgh, Scotland.
Recessional.

CONVOCATION

Friday, 8:15-10:30 p.m.—Ballroom, The Stevens

FREDERICK A. COLLER, M.D., F.A.C.S., Ann Arbor; President, American College of Surgeons, Presiding.
Processional—Initiates, Officers, Regents, and Distinguished Guests.
Invocation.
Presentation of Initiates for Fellowship. IRVIN ABELL, M.D., F.A.C.S., Louisville; Chairman, Board of Regents.
Fellowship Pledge. Recital by Initiates.
Conferring of Fellowships by the President. FREDERICK A. COLLER, M.D.
Conferring of Honorary Fellowships. The President.
Fellowship Address: Science in Surgery—Stop, and Look, and Listen. LORD WEBB-JOHNSON, K.C.V.O., C.B.E., D.S.O., T.D., F.A.C.S. (Hon), London.
Recessional.

EVENING SCIENTIFIC SESSIONS

Tuesday, 8:00—10:30 p.m.

Symposium on Acute Surgical Emergencies in Gynecology and Obstetrics—
- General Introduction. NEWELL W. PHILPOTT, M.D., F.A.C.S., Montreal.
- Tubal Pregnancy, Its Diagnosis and Treatment. LEWIS C. SCHEFFEY, M.D., F.A.C.S., Philadelphia.
- Pelvic Peritonitis Occurring in the Obstetrical or Gynecological Patient. FRANK GLENN, M.D., F.A.C.S., New York.
- Emergency Cesarean Section. WILLIAM E. STUDDIFORD, M.D., F.A.C.S., New York.

Wednesday, 8:00—10:30 p.m.

Fracture Oration. Fracture Hazards. OTTO J. HERMANN, M.D., F.A.C.S., Boston.
Symposium on Blood Coagulation and the Use of Anticoagulants—
- The Significance of Different Methods for Prothrombin Estimation and Their Relative Values. JOHN H. OLWIN, M.D., F.A.C.S., Chicago.
- Studies on Antithrombin and Etiologic Factors in Phlebothrombosis. JOHN H. KAY, M.D., New Orleans.
- A Further Report on Dicumarol Prophylaxis Against Venous Thrombosis in Women. GEORGE VAN S. SMITH, M.D., F.A.C.S., Brookline, Massachusetts.

Thursday, 8:00—10:30 p.m.

Symposium on Malignant Disease—
- Chemotherapy in Malignant Neoplastic Disease. CARL V. MOORE, M.D., St. Louis.
- Hormone Therapy of Cancer. CHARLES B. HUGGINS, M.D., Chicago.
- What We Have Learned from Isotopes Concerning Depletion and Repair in Surgical Patients. FRANCIS D. MOORE, M.D., F.A.C.S., Boston.
- The Use of Radioactive Iodine in Studying the Pathologic Physiology of Thyroid Cancer. RULON W. RAWSON, M.D., New York.

PANEL DISCUSSIONS

GENERAL SURGERY

Monday, 1:30—3:00 p.m.

Surgical Lesions of the Breast—
- Moderator: GEORGE G. FINNEY, M.D., F.A.C.S., Baltimore.
- Collaborators: J. MONTGOMERY DEAVER, M.D., F.A.C.S., Philadelphia; STUART W. HARRINGTON, M.D., F.A.C.S., Rochester, Minnesota; W. PERRIN NICOLSON, M.D., Atlanta; HUGH H. TROUT, M.D., F.A.C.S., Roanoke.

Monday, 3:30—5:00 p.m.

Fractures of the Skull—
- Moderator: ELDRIDGE H. CAMPBELL, M.D., F.A.C.S., Albany.
- Collaborators: FRANK H. MAYFIELD, M.D., F.A.C.S., Cincinnati; DONALD MUNRO, M.D., F.A.C.S., Boston; HARRY B. WILKINS, M.D., F.A.C.S., Oklahoma City.

Tuesday, 1:30—3:00 p.m.

Massive Upper Abdominal Hemorrhage—
- Moderator: JOHN H. MULHOLLAND, M.D., F.A.C.S., New York.
- Collaborators: ROBERT ELMAN, M.D., F.A.C.S., St. Louis; CHARLES G. JOHNSTON, M.D., F.A.C.S., Detroit; JOHN D. STEWART, M.D., F.A.C.S., Buffalo.

Tuesday, 3:30—5:00 p.m.

New Surgical Technics in Drug Treated Infections—
- Moderator: CHAMP LYONS, M.D., New Orleans.
- Collaborators: HARVEY S. ALLEN, M.D., F.A.C.S., Chicago; FRANK B. BERRY, M.D.,

F.A.C.S., New York; GEORGE K. CARPENTER, M.D., F.A.C.S., Nashville.

Wednesday, 1:30—3:00 p.m.

The Management of Acute Emergencies Occurring During Operations—
Moderator: I. MIMS GAGE, M.D., F.A.C.S., New Orleans.
Collaborators: BENTLEY P. COLCOCK, M.D., F.A.C.S., Boston; DANIEL C. ELKIN, M.D., F.A.C.S., Atlanta; NORMAN E. FREEMAN, M.D., F.A.C.S., San Francisco; CARL A. MOYER, M.D., F.A.C.S., Dallas.

Wednesday, 3:30—5:00 p.m.

Preoperative and Postoperative Care and Anesthesia for Infants—
Moderator: THOMAS H. LANMAN, M.D., F.A.C.S., Boston.
Collaborators: C. EVERETT KOOP, M.D., Philadelphia; WILLIS J. POTTS, M.D., F.A.C.S., Chicago; ROBERT M. SMITH, M.D., Boston.

SYMPOSIUM ON AMPUTEES

Tuesday, 10:00 a.m.—12:00 noon

ROBERT H. KENNEDY, M.D., F.A.C.S., New York; chairman, Committee on Trauma, Presiding.

The Care and Education of Amputees. RUFUS H. ALLDREDGE, M.D., F.A.C.S., New Orleans; HENRY H. KESSLER, M.D., F.A.C.S., Newark; and LEONARD T. PETERSON, M.D., F.A.C.S., Washington, D.C.

SYMPOSIUM ON TRAUMA

Tuesday, 2:00—5:00 p.m.

ROBERT H. KENNEDY, M.D., F.A.C.S., New York; chairman, Committee on Trauma, Presiding.

Plastic Surgical Repair of Radiation Injuries. JAMES BARRETT BROWN, M.D., F.A.C.S., St. Louis.

Observations on Results of Shoulder Cuff Repair. HARRISON L. MCLAUGHLIN, M.D., F.A.C.S., New York.

Use of Intramedullary Fixation in Fractures. HAROLD A. SOFIELD, M.D., F.A.C.S., Chicago.

A Prolonged End-Result Study of 235 Intracapsular Fractures of the Femoral Neck. MATHER CLEVELAND, M.D., F.A.C.S., New York.

An Analysis of the Management and Complications of Multiple (3 or more) Rib Fractures. DUNCAN A. CAMERON, M.D., Detroit.

Blood and Blood Substitutes in Trauma. JONATHAN E. RHOADS, M.D., F.A.C.S., Philadelphia.

Fractures of the Tarsal and Metatarsal Bones. FRANCIS M. MCKEEVER, M.D., F.A.C.S., Los Angeles.

Reconstructive Surgery Following Trauma. TRUMAN G. BLOCKER, JR., M.D., F.A.C.S.

SYMPOSIUM ON CANCER

Wednesday, 2:00—5:00 p.m.

GRANTLEY W. TAYLOR, M.D., F.A.C.S., Boston; chairman, Cancer Committee, American College of Surgeons, Presiding.

Melano-epitheliomas. HAMILTON MONTGOMERY, M.D., Rochester, Minnesota.

Benign Bone Tumors. MURRAY M. COPELAND, M.D., F.A.C.S., Washington, D.C.

Branchiogenic Cancer. HAYES MARTIN, M.D., F.A.C.S., New York.

What Is a Precancerous Lesion? FRED W. STEWART, M.D., New York.

Cancer of the Kidney. HERMAN L. KRETSCHMER, M.D., F.A.C.S., Chicago.

Sarcomas of the Soft Parts. ARTHUR PURDY STOUT, M.D., New York.

SURGICAL SPECIALTIES

PANEL DISCUSSIONS

Friday, 1:30—4:45 p.m.

ORTHOPEDIC SURGERY

Moderator: GUY A. CALDWELL, M.D., F.A.C.S., New Orleans.

Management of Established Non-Union of the Long Bones.
Collaborators: HUGH SMITH, M.D., F.A.C.S., Memphis; FRANK E. STINCHFIELD, M.D., F.A.C.S., New York; ALEJANDRO VELASCO ZIMBRON, M.D., Mexico City.

Indications and Technic for Arthrodeses of the Joints of the Foot and Ankle in Post-Traumatic Conditions.
Collaborators: HAROLD B. BOYD, M.D., F.A.C.S., Memphis; JAMES A. DICKSON, M.D., F.A.C.S., Cleveland; C. LESLIE MITCHELL, M.D., F.A.C.S., Detroit.

PLASTIC SURGERY

Moderator: JEROME P. WEBSTER, M.D., F.A.C.S., New York.

Plastic Surgery and the Treatment of Malignant Skin Disease.

Collaborators: JAMES BARRETT BROWN, M.D., F.A.C.S., St. Louis; W. BRANDON MACOMBER, M.D., F.A.C.S., Albany; CLAIRE L. STRAITH, M.D., F.A.C.S., Detroit.

The Use of Skin Homografts.

Collaborators: JAMES F. CONNELL, M.D., Fort Sam Houston; WILLIAM P. LONGMIRE, JR., M.D., Los Angeles; BLAIR O. ROGERS, M.D., Minneapolis.

UROLOGY

Moderator: GEORGE F. CAHILL, M.D., F.A.C.S., New York.

Hydronephrosis Due to Upper Ureter Obstruction.

Collaborators: GRAYSON L. CARROLL, M.D., F.A.C.S., St. Louis; FRED E. B. FOLEY, M.D., St. Paul; PARKE G. SMITH, M.D., F.A.C.S., Cincinnati.

Ureteral Intestinal Transplantation.

Collaborators: CHARLES C. HIGGINS, M.D., F.A.C.S., Cleveland; VICTOR F. MARSHALL, M.D., F.A.C.S., New York; JAMES T. PRIESTLY, M.D., F.A.C.S., Rochester.

THORACIC SURGERY

Moderator: BRIAN B. BLADES, M.D., F.A.C.S., Washington.

Surgery of the Heart and Great Vessels.

Collaborators: ALFRED BLALOCK, M.D., F.A.C.S., Baltimore; THOMAS H. BURFORD, M.D., F.A.C.S., St. Louis; EDWARD M. KENT, M.D., Pittsburgh.

Intrathoracic Tumors.

Collaborators: (Same as above)

NEUROLOGICAL SURGERY

Moderator: ALFRED W. ADSON, M.D., F.A.C.S., Rochester, Minnesota.

Chemical and Physical Diagnostic Aids in the Localization of Brain Tumors.

Collaborators: GEORGE MOORE, M.D., Minneapolis; ERIC OLDBERG, M.D., F.A.C.S., Chicago; BERTRAM SELVERSTONE, M.D., Boston; HENDRICK J. SVIEN, M.D., Rochester; WILLIAM H. SWEET, M.D., Boston.

Diagnosis and the Localization of Intraspinal Tumors.

Collaborators: PAUL C. BUCY, M.D., F.A.C.S., Chicago; T. C. ERICKSON, M.D., Madison; HAROLD C. VORIS, M.D., F.A.C.S., Chicago.

OBSTETRICS AND GYNECOLOGY

Moderator: FRANKLIN L. PAYNE, M.D., F.A.C.S., Philadelphia.

Carcinoma of the Uterine Cervix—Modern Concepts in Diagnosis and Treatment.

Collaborators: ROBERT GORDON DOUGLAS, M.D., New York; HERBERT F. TRAUT, M.D., F.A.C.S., San Francisco; PAUL A. YOUNGE, M.D., Brookline.

Cesarean Section—Should the Latitude of Its Indications be Broadened.

Collaborators: D. ANTHONY D'ESOPO, M.D., New York; CARL P. HUBER, M.D., Indianapolis; H. HUDNALL WARE, JR., M.D., F.A.C.S., Richmond.

TWENTY-EIGHTH ANNUAL HOSPITAL STANDARDIZATION CONFERENCE

Monday, 10:00 a.m.–12:30 p.m.

GENERAL ASSEMBLY

DALLAS B. PHEMISTER, M.D., F.A.C.S., Chicago; president, American College of Surgeons, Presiding.

The Ever Present Challenge—Good Care of the Patient. IRVIN ABELL, M.D., F.A.C.S., Chicago; chairman, Board of Regents, American College of Surgeons.

The Health of the Nation—Our Greatest Asset. HARRISON RAY ANDERSEN, D.D., Chicago; Pastor, Fourth Presbyterian Church.

The Voluntary Hospital—The Foundation of the Present Hospital System. REV. JOHN W. BARRETT, Chicago; director of Catholic Hospitals, Archdiocese of Chicago; president, Catholic Hospital Association.

Trends in Legislation Affecting Hospitals. GEORGE BUGBEE, Chicago; executive director, American Hospital Association.

Monday, 2:00–5:00 p.m.

Panel Discussion—Standards of Professional Services for the Good Care of the Patient as Rendered by:

The Radiologist, the Pathologist, the Anesthesiologist, the Physical Therapist.

Tuesday, 10:00 a.m.–12:30 p.m.

Standards for the Institutional Care of: Psychiatric Patients in (a) Mental Hospitals, (b) General Hospitals; Tuberculous Patients in (a) Sanatoria, (b) General Hospitals.

Tuesday, 2:00–5:00 p.m.

Seminar and Round Table Conference Discussion of Standards for Hospitals.

Tuesday, 7:30–10:00 p.m.

Special Collaborative Conference for Doctors, Hospital Trustees and Administrators

Theme: Understanding and Cooperation from the standpoint of the Doctor, the Trustee, and the Administrator.

Wednesday, 8:00–9:30 a.m.

Breakfast Conference on Public Relations—Joint Session for Press and Radio Representatives and Hospital and Medical Personnel.

Wednesday, 10:00 a.m.–12:30 p.m.

Theme—Hospital Costs and Maintenance of Standards

Present and Future Trends in Hospital Costs; Financial Responsibility for the Indigent; Blue Cross and Blue Shield Plans as Factors in Relieving the Hospital's Financial Burden.

Wednesday, 2:00–5:00 p.m.

Theme—The Medical Staff of the Hospital: Basic Considerations in Organization, Duties and Responsibilities

Essentials of Adequate Medical Staff Organization; Control of the Professional Work; Review and Analysis of the Clinical Work.

Wednesday, 8:00–10:00 p.m.

Discussion Conference with the Field Staff of the American College of Surgeons on the Activities of the College as they Affect Hospitals

Hospital Standardization and Point Rating; Graduate Training in Surgery; Medical Service in Industry, Library and Department of Literary Research; Medical Motion Pictures; Sectional Meetings; Committee on Trauma; Cancer Committee; Publications; Public Relations.

Thursday, 8:00–9:30 a.m.

Breakfast Conference for Graduates and Administrative Residents of University Programs in Hospital Administration, and Course Directors.

Experience Exchange: My First Year of Administering a Hospital.

Thursday, 10:00 a.m.–12:30 p.m.

Theme—Discussion of Current Problems in Hospitals

General Practice Division; Methods of Improving Medical Records; Dental Service; the Administrator and the Atom; Problems of the Small Hospital.

Thursday, 2:00–5:00 p.m.

Forum on Trends in Hospital Administration, New Ideas and Special Hospital Problems

Selected topics from transcripts submitted by graduates in hospital administration and administrative residents.

Thursday, 8:00–10:00 p.m.

Open Forum on Nursing

Representatives of American Medical Association, American Hospital Association, American College of Surgeons, American College of Physicians, Catholic Hospital Association, American Protestant Hospital Association, American Nurses' Association, National League of Nursing Education, United States Public Health Service, United States Veterans Administration.

Friday, 10:00 a.m.–12:00 Noon and 2:00–5:00 p.m.

Demonstrations in Selected Chicago Hospitals.

SIXTH INTER-AMERICAN CONGRESS OF SURGERY

Chicago, Illinois, October 17 to 23, 1949

Separate Sessions - October 21, 22, and 23

THE Sixth Inter-American Congress of Surgery will be included in the Thirty-fifth Clinical Congress of the American College of Surgeons from October 17 to 21, with headquarters at The Stevens in Chicago, and will continue on October 21, 22, and 23 with its own business, scientific, and social sessions, most of which will be held in the John B. Murphy Memorial Auditorium of the College at 50 East Erie Street.

The following surgical societies, in addition to the American College of Surgeons, are members of the Association of Inter-American Congresses of Surgery:

Argentine Association of Surgery, Buenos Aires, Argentina
Bolivian Society of Surgery, La Paz, Bolivia
Brazilian College of Surgery, Rio de Janeiro, Brazil
Society of Surgery of Chile, Santiago de Chile, Chile
Society of Hospital Surgeons, Santiago de Chile, Chile
National Society of Surgery, Havana, Cuba
Society of Medicine and Surgery of Quito, Ecuador
Mexican Academy of Surgery, Mexico, D. F.
Indo-Latin College of Surgery, Mexico, D. F.
National Association of Medicine and Surgery, Panama
Society of Medicine and Surgery, Asuncion, Paraguay
Peruvian Academy of Surgery, Lima, Peru
Society of Surgery, Montevideo, Uruguay

The American College of Surgeons joined the association by vote of the Board of Regents on June 27, 1943. This action was preceded by an invitation from Dr. Luis Vargas Salcedo of Santiago, Chile, to send two delegates as guests of honor to the First Inter-American Congress of Surgery, held in Santiago November 15 to 19, 1942. Dr. Leo Eloesser, of San Francisco, attended as delegate, and it was upon his enthusiastic recommendation that the College joined the association. He also attended the second Congress, in Buenos Aires, October 10 to 15, 1943. Dr. Alton Ochsner, of New Orleans, was delegate to the third Congress, held in Montevideo, Uruguay, October 1 to 6, 1946. No delegates were sent to the fourth Congress, held in Rio de Janeiro in 1947. Dr. E. Payne Palmer, of Phoenix, and Dr. Hu Crim Myers, of Philippi, West Virginia, were delegates and co-relators at the fifth Congress, held in La Paz, Bolivia, October 17 to 21, 1948.

Dr. Frederick A. Coller, who will be installed on October 17 as President of the American College of Surgeons, will, as President of the signatory society of surgeons in the host country, serve as President of the Sixth Inter-American Congress of Surgery; Dr. Arnaldo Caviglia, of Buenos Aires, is Secretary-General of the Association of Inter-American Congresses of Surgery, and will set up an office in Chicago prior to and during the meeting.

The Department of State of the United States of America has issued official invitations to the governments of the eleven other countries which have surgical societies belonging to the Association of Inter-American Congresses of Surgery, to send officially authorized delegates to the forthcoming Sixth Congress of Surgery. Most of the member societies have signified the intention of appointing delegates to the Congress and most of the co-relators have also been named.

THE PROGRAM

A preliminary outline of the program for the Sixth Inter-American Congress of Surgery follows:

Friday morning, October 21

Inaugural Ceremony.
Address of the President of the Sixth Inter-American Congress of Surgery. FREDERICK A. COLLER, M.D., F.A.C.S., Ann Arbor; President, American College of Surgeons.
Report of the Secretary-General. ARNALDO CAVIGLIA, M.D., Buenos Aires; Secretary-General, Association of Inter-American Congresses of Surgery.
Official Greetings. United States Government representatives.
Greetings from the Signatory Societies. Official representatives to the Sixth Inter-American Congress of Surgery.

Friday, 12:00–1:30, October 21

Luncheon.

Friday afternoon, October 21

Specialty panels of the Clinical Congress.

Saturday morning, October 22

Main Theme: Acute Craniocerebral Trauma.
Relator: E. JEFFERSON BROWDER, M.D., F.A.C.S., Brooklyn, New York, U. S. A.
Co-relators: To be appointed by each member country.

Saturday afternoon, October 22

Main theme: Treatment of Injuries in the Region of the Ankle with Complications and Sequelae.
Relator: HARRISON L. MCLAUGHLIN, M.D., F.A.C.S., New York, New York, U.S.A.
Co-relators: To be appointed by each member country.

Saturday evening, October 22

Official Banquet.

Sunday morning, October 23

Business Session.
Luncheon.

Sunday afternoon, October 23

Main Theme: Pulmonary Carcinoma.
Relator: EVARTS A. GRAHAM., M.D., F.A.C.S., St. Louis, Missouri, U.S.A.
Co-relators: To be appointed by each member country.

The following committees will aid in the arrangements for the Sixth Inter-American Congress of Surgery:

COMMITTEES ON INTER-AMERICAN RELATIONS, AMERICAN COLLEGE OF SURGEONS

General Committee on Inter-American Relations

IRVIN ABELL, Louisville, *Chairman*
ALFRED BLALOCK, Baltimore
FRANCIS P. CORRIGAN, New York
LEO ELOESSER, San Francisco
RUDOLPH MATAS, New Orleans
OSCAR L. MILLER, Charlotte, N.C.
HOWARD C. NAFFZIGER, San Francisco
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Committee on Press and Radio

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THIRTEENTH CONGRESS, INTERNATIONAL SOCIETY OF SURGERY

(Société Internationale de Chirurgie)

New Orleans, Louisiana, U.S.A., October 9 to 15, 1949

THE following announcement has been received from Dr. L. Dejardin, Secretary-General of the International Society of Surgery:

Plans for the Thirteenth Congress of the International Society of Surgery, which will take place in New Orleans, Louisiana, under the Presidency of Professor George Grey Turner, of London, England, are now in course of preparation.

The scientific program was settled by the General Assembly at the last Congress in London, held in September, 1947. This body, at the recommendation of the Scientific Committee, also accepted two additional subjects, and decided who should open each discussion. The final arrangements were as follows:

1. Surgery and Pathology of the Pancreas, Especially in Relation to Its Endocrine Function. Opened by PROFESSOR IAN AIRD, London.
2. Surgery of the Parathyroid Glands. Opened by DR. PAOLUCCI, Rome.
3. Surgery of the Suprarenal Glands. Opened by DR. M. R. FONTAINE, Strasburg.
4. Pathology and Surgery of the Pituitary Glands. Opened by DR. M. P. MARTIN, Brussels.
5. Treatment of Postoperative Thrombosis and Its Sequelae. Opened by DR. ALTON OCHSNER, New Orleans, and DR. MICHAEL DE BAKEY, Houston.
6. Causes of Recurrence after Operations on the Biliary Tract. Opened by DR. M. R. DEMEL, Vienna.

In addition, the American Organizing Committee has arranged that two or three days of the meeting shall be devoted to the presentation of shorter papers on subjects of immediate interest.

The complete program, both scientific and social, will be circulated in due course.

The program is being formulated by Vice President Evarts A. Graham, of St. Louis, Missouri.

OFFICERS FOR THE BIENNIUM

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G. SPEHL, Brussels, Belgium, *Editor, "Journal International de Chirurgie"*
I. MIMS GAGE, New Orleans, Louisiana, *Secretary of the 13th Congress*

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DANIEL C. ELKIN, Atlanta, Georgia
ALTON OCHSNER, New Orleans, Louisiana

Inquiries should be directed to:
DR. L. DEJARDIN, *Secretary-General*
International Society of Surgery
141, Rue Belliard, Brussels, Belgium.